STDI-0002

The Compendium of Controlled Extensions (CE)

for the

National Imagery Transmission Format (NITF)

Version 1.0, 25 August 1998

FOREWORD

1. The National Imagery Transmission Format Standard (NITFS) is the suite of standards for formatting digital imagery and imagery-related products and exchanging them among the Department of Defense (DOD), other Intelligence Community (IC) members, and other United States (US) Government departments and agencies. Resulting from a collaborative US Government and industry effort, it is the common standard used to exchange and store files composed of images, symbols, text, and associated data.

2. This Support Data Extension (SDE) compendium provides the approved SDE specifications to be used with the National Imagery Transmission Format (NITF) versions 2.0 (NITF2.0) or 2.1 (NITF2.1). This compendium is an unclassified companion to NSDE/-97, *National Support Data Extensions (SDE) (Version 1.2) for the National Imagery Transmission Format Standard (NITFS), 13 March 1997*. The documents do not overlap or conflict. SDE Implementation requirements are defined in N0105-98, *NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan*, *Draft 6, 19 May 1998.*

3. The NITFS Technical Board (NTB) and its Format (FWG), Bandwidth Compression (BCWG), and Communications (CWG) Working Groups develop, coordinate, review, and plan for NITFS. It is a consensus-based government/industry forum that responds to the Geospatial and Imagery Standards Management Committees (GSMC and ISMC). The GSMC and ISMC manage geospatial and imagery standards for the DOD and IC encompassed by the US Imagery and Geospatial Information System (USIGS).

4. Changes to this compendium are controlled by the NTB and the National Imagery and Mapping Agency (NIMA) Configuration Control Board (NCCB). Beneficial comments and data that can be used to improve this document should be addressed to Danny Rajan at NIMA, Standards and Interoperability Division, MS P-24, 12310 Sunrise Valley Drive, Reston, VA 20191-3449, electronic mail, rajans@nima.mil, voice (703) 262-4416.

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1.0 SCOPE

This compendium defines the specifications for the approved and controlled NITFS Support Data Extensions (SDE). NITF2.0 SDE implementation is defined in MIL-STD-2500A. NITF2.1 SDE implementation is defined in MIL-STD-2500B.

1.1 PURPOSE

This compendium provides the technical specifications and implementation requirements that USIGS systems must support when implementing NITFS SDEs. Specific implementation requirements denoting which extensions should be implemented by the various USIGS systems are defined in the N0102, USIGS Interoperability Profile (UIP).

1.2 APPLICABILITY

This plan applies to DOD, IC, and NATO NITFS implementers that need to electronically exchange imagery support data.

2.0 REFERENCES

2.1 DEPARTMENT OF DEFENSE STANDARDS AND HANDBOOK

MIL-STD-2500A	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 12 October 1994 with Notice 1, 7 February 1997 and Notice 2, 26 September 1997
MIL-STD-2500B	National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, 22 August 1997
MIL-STD-188-196	Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 27 June 1996
MIL-STD-188-198A	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with Notice 1, 12 October 1994 and Notice 2, 14 March 1997
MIL-STD-188-199	Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 with Notice 1, 27 June 1996
MIL-STD-2301	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 12 October 1994
MIL-STD-2301A	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard
MIL-STD-2045-44500	Tactical Communications Protocol 2 (TACO2) for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 29 July 1994 and Notice 2, 27 June 1996
MIL-STD-188-197A	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard, 12 October 1994
MIL-STD-2411	Raster Product Format, 5 October 1994
MIL-STD-2411-1	Registered Data Values for Raster Product Format, 30 August 1994
MIL-STD-2411-2	Integration of Raster Product Format Files into the National Imagery Transmission Format, 26 August 1994
MIL-HDBK-1300A	National Imagery Transmission Format Standard (NITFS), 12 October 1994

(Copies of the above standards and handbook are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 OTHER DEPARTMENT OF DEFENSE PUBLICATIONS

DOD/JTA V2.0	Department of Defense Joint Technical Architecture Version 2.0, March 1998

(Copies of the JTA are available from the Defense Information Systems Agency, Center for Standards, 10701 Parkridge Boulevard, Reston, VA 20191-4353.)

2.3 JOINT CHIEF OF STAFF PUBLICATIONS

JV2010	Joint Vision 2010, Chairman of the Joint Chiefs of Staff, Office of the Secretary of Defense
CJCSI 6212.01A	Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems, 30 June 1995

2.4 NATIONAL IMAGERY AND MAPPING AGENCY PUBLICATIONS

N0105 DRAFT	NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, Review Draft 4, 8 September 1997
NPIAE	NIMA Profile for Imagery Archive Extensions (NPIAE) for the National Imagery Transmission Format Standard (NITFS), 26 September 1997
NSDE/97	National Support Data Extensions (SDE) (Version 1.2) for the National Imagery Transmission Format Standard (NITFS), 13 March 1997
RASG-9606-001	Airborne Synthetic Aperture Radar (SAR) Support Data Extensions (SDE) for the National Imagery Transmission Format (Version 2.0) of the National Imagery Transmission Format Standard, Version 0.9, 20 May 1996
RMAG-9709-001	Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions for the National Imagery Transmission Format (NITF) of the National Imagery Transmission Format Standard, 25 September 1997
NNPP	NITFS Five-Year Program Plan

(Copies of the above NIMA publications are available from the National Imagery and Mapping Agency, ATTN: NIMA/SES, MS-P24, 12310 Sunrise Valley Drive, Reston, VA. 20191-3449.)

2.5 DEFENSE INFORMATION SYSTEMS AGENCY PUBLICATIONS

JIEO Circular 9002	Requirements Assessment and Interoperability Certification of C4I and AIS Equipment and Systems, 23 January 1995
JIEO Circular 9008	NITFS Certification Test and Evaluation Program Plan, 30 June 1993, with Errata Sheet dated 24 July 1996
NITFS Tag Registry	Official Register of NITFS Tagged Record Extensions, latest update as posted at http://jitc-emh.army.mil/nitf/tag_reg/mast.htm

(Copies of the above documents are available from the Joint Interoperability Test Command, NITFS Test Facility, Building 57305, Fort Huachuca, AZ 85613-7020.)

2.6 NATO STANDARDIZATION AGREEMENTS

STANAG 4545	NATO Secondary Imagery Format

(Copies of NATO documents are available from the Central US Registry, 3072 Army, Pentagon, Washington DC 20310-3072.)

2.7 INTERNATIONAL STANDARDS

ISO/IEC 12087-5	Information technology - Computer graphics and image processing - Image Processing and Interchange (IPI) - Functional specification - Part 5: *Basic image interchange format (BIIF)*
ISO/IEC 8632-1,2,3,4:1994	Information technology - Computer graphics metafile for the storage and transfer of picture description information - Parts 1 through 4
ISO/IEC 8632:1992	Information technology - Computer graphics metafile for the storage and transfer of picture description information, AMD.1:1994 - Parts 1-4: Rules for profiles
ISO/IEC 10918-1:1994	Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines
ISO/IEC 10918-4:1998	Information technology - Digital compression and coding of continuous-tone still images - Part 4: Registration procedures for JPEG profile, APPn marker, and SPIFF profile ID marker

(Application for copies may be addressed to the American National Standards Institute, 13th Floor, 11 West 42nd Street, New York, NY 10036).

3.0 ACRONYMS

ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
BIIF	Basic Image Interchange Format
BWCWG	Bandwidth Compression Working Group (under NTB)
CADRG	Compressed ARC Digitized Raster Graphics
CCITT	International Telegraph and Telephone Consultative Committee
CD	Committee Draft
CGM	Computer Graphics Metafile
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
CTE	Certification, Test, Evaluation
CWG	Communications Working Group (under NTB)
DGIWG	Digital Geographic Information Working Group
DIA	Defense Intelligence Agency
DIGEST	Digital Geographic Information Exchange Standard
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DOD	Department of Defense
DPPDB	Digital Point Positioning Data Base
DSP	Defense Standardization Program
DSPO	Defense Support Project Office
EO	Electro-Optical
FEC	Forward Error Correction
FGDC	Federal Geographic Data Committee
FWG	Format Working Group (under NTB)
GIS	Geographic Information System
GSMC	Geospatial Standards Management Committee
IC	Intelligence Community

IEC	International Electrotechnical Commission
INCA	Intelligence Communications Architecture
IR	Infrared
IS	International Standard
ISMC	Imagery Standards Management Committee
ISO	International Organization for Standardization
ISP	International Standardized Profile
ITU	International Telecommunications Union
JITC	Joint Interoperability Test Command
JPEG	Joint Photographic Experts Group
JTA	Joint Technical Architecture
JTC1	Joint Technical Committee for Information Technology
JV	Joint Vision
MPEG	Motion Pictures Expert Group
NATO	North Atlantic Treaty Organization
NCCB	NIMA Configuration Control Board
NIMA	National Imagery and Mapping Agency
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NPIAE	NIMA Profile for Imagery Archive Extensions
NSIF	NATO Secondary Imagery Format
NTB	NITFS Technical Board (under GSMC - ISMC)
OASD	Office of the Assistant Secretary of Defense
OSD	Office of the Secretary of Defense
PMO	Program Management Office
RFC	Request for Change
RPF	Raster Product Format
SAR	Synthetic Aperture Radar
SDE	Support Data Extension

SDTS	Spatial Data Transfer Standard
TACO2	Tactical Communications Protocol 2
TRE	Tagged Record Extension
UAV	Unmanned Aerial Vehicle
UIP	USIGS Interoperability Profile
US	United States
USGS	United States Geological Survey
USIGS	United States Imagery and Geospatial Information System
UTA	USIGS Technical Architecture
VPF	Vector Product Format
VQ	Vector Quantization
WD	Working Draft

4.0 SUPPORT DATA EXTENSION (SDE) GENERAL OVERIEW

4.1 GENERIC TAGGED RECORD EXTENSION (TRE) MECHANISM.

The Tagged Record Extensions (TRE) defined in this document are "Controlled tagged record Extensions" (CE) as defined in Section 5.9 of MIL-STD-2500. The TRE format is summarized here for ease of reference. Table 4-1 describes a CE's general format.

TABLE 4-1. CONTROLLED TAGGED RECORD EXTENSION FORMAT
(TYPE R = Required, C = Conditional, <> = null data allowed)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Type Identifier. A valid alphanumeric identifier properly registered with the NTB.	6	alphanumeric	N/A	R
CEL	Length of CEDATA Field. The length in bytes of the data contained in CEDATA. The TRE's overall length is the value of CEL + 11.	5	00001 to 99985	bytes	R
CEDATA	User-Defined Data. This field shall contain data primarily of character data type (binary data is acceptable for extensive data arrays, such as color palettes or look-up tables) defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user defined.	†	user-defined	N/A	R

† equal to value of CEL field.

The Unique Extension type Identifier (CETAG) and Length of CEDATA Field (CEL) fields essentially form a small (11-byte) TRE subheader. The format and meaning of the data within the User-Defined Data (CEDATA) field is the subject of this document for several, individual CEs.

Multiple TREs can exist within the TRE area. There are several such areas, each of which can contain 99,999 bytes worth of TREs. There is also an overflow mechanism, should the sum of all TREs in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of TREs.

While the CEs defined in this document will typically be found in the image subheader, it is possible that they could appear in the Tagged Record Extension Overflow (TRE_OVERFLOW) Data Extension Segment (DES) which is being used as an overflow of the image subheader.

If the information contained within a TRE is not available, the extension will not be present in the file or segment. For example, if the image is not part of a stereo set, the STERO extension will not be present. The set of TRE stored within the file or segment can change over the lifetime of the image, due to additional information, removal of outdated information, or change in classification. Additional tables indicate which TRE must appear in every file or segment and which may be omitted.

When a TRE is present, all of the information listed as Required (R) must be filled in with valid information. Information listed as Conditional (C) may or may not be present, depending upon the value in a preceding field. Conditional fields that are not present do not occupy space in the file. Information identified with angle brackets (<R> or <C>) may contain valid information, or may contain ASCII spaces (i.e., hex 20) to indicate a null field and that valid data is unavailable.

Alphanumeric values that do not fill the allotted space are left justified within a field, and the remaining bytes are filled with ASCII spaces (i.e., hex 20). Numeric values are right justified within the field, with ASCII zeros (i.e., hex 30) extending to the left field boundary.

Reserved fields, identified by names of the form “(reserved-nnn)” maintain alignment and functional equivalence with similar extensions defined for systems beyond the scope of this document. The content of reserved fields is explicitly specified in the Value Range column. Systems generating these TREs shall insert the specified value into each reserved field; systems interpreting them may ignore the contents of reserved fields.

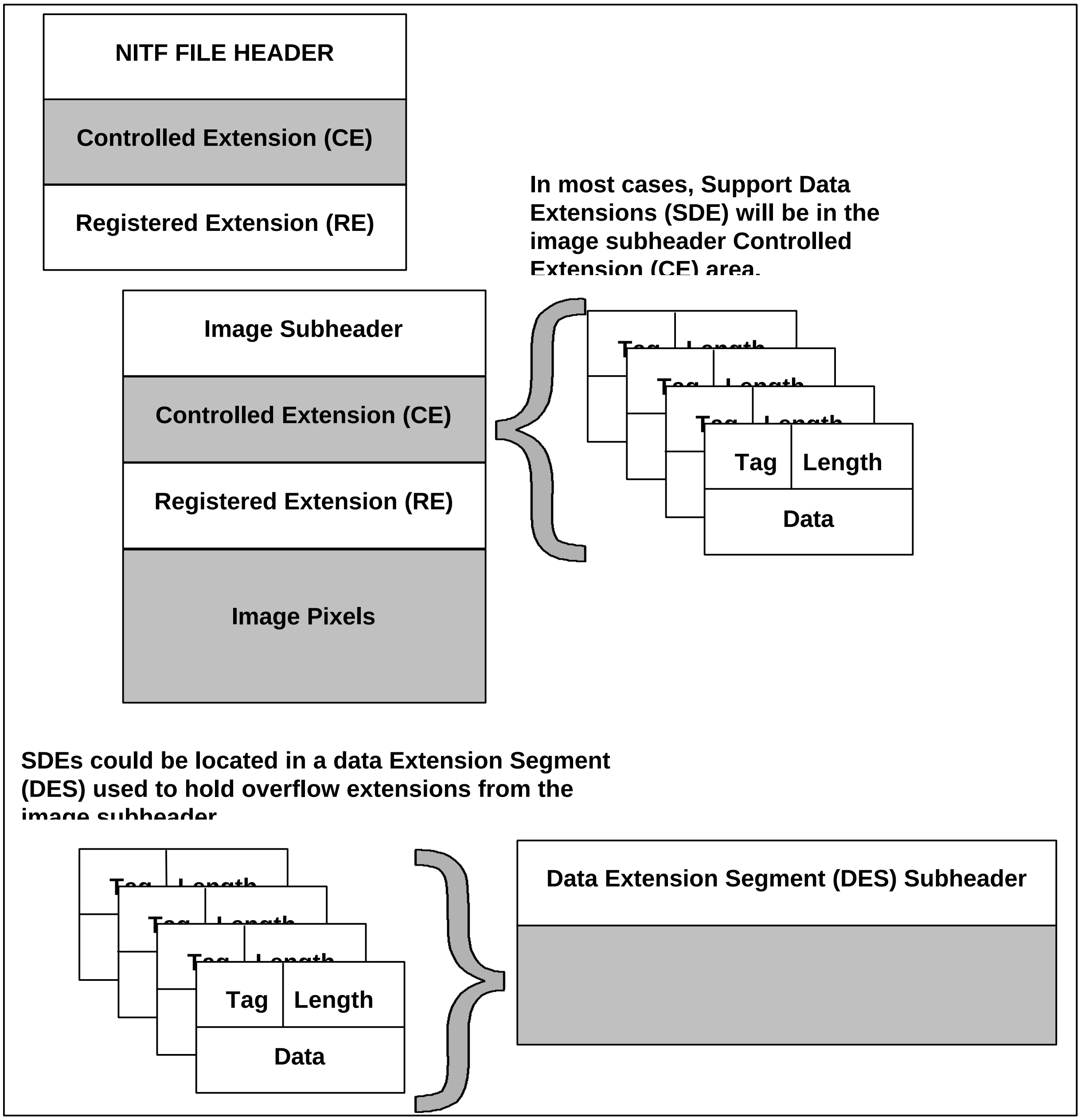

FIGURE 1-1. SUPPORT DATA EXTENSIONS (SDEs) MAY BE LOCATED IN THESE AREAS

If the information contained within an extension is not available, the extension will not be present in the file. For example, many images may not contain an STREOB. If the intended use of a file does not require the information contained in an extension, it is not required to be present. The set of extensions stored within the file can change over the lifetime of the image. For example, the RPC00A tag may be added to the file at some time after the NITF 2.0 file is initially created, or additional STREOB extensions could be added as stereo mates are identified. When an extension is present, all of the information listed as required must be filled in.

5.0 ICHIPA SUPPORT DATA EXTENSION (SDE)

5.1 OVERVIEW

As mensuration and geo-positional tools proliferate within the USIGS environment and the use of NITF image chips continues to expand, potential problems have been identified by the NTB. One such problem arises when a mensuration tool, such as RULER, is applied to an NITF image chip to determine the length or geo-position of an object within that chip. RULER requires, as input, data that references the original full image as well as the image chip. This information is not provided within the NITF 2.0 header/subheader fields, or within the NITF SDE fields. This has resulted in the implementation of various, non-standard solutions for transferring this much needed "chipping" data along with a NITF chip. The proposed ICHIPA SDE is an attempt to standardize the solution so that any recipient of an image, regardless of system or application, will be able to access the necessary data and apply RULER to the image chip in a uniform and consistent manner.

5.2 ICHIPA IMPLEMENTATION

ICHIPA is a system-independent NITF SDE that, when included with all NITF image chips, will support all users within the USIGS environment for image chip mensuration. It holds the support data that analysts need when using RULER to mensurate or determine detailed geospatial parameters on pixel based features within image chips. ICHIPA also holds other limited processing related information, such as various correction indicators and scale factor, that is useful to receiving systems.

It is recommended that the ICHIPA CE be generated by all NITF systems that generate NITF formatted image chips, which include the RULER data extensions, and sent electronically to other NITF users. NITF receiving systems will be expected to read and interpret the information within ICHIPA if they have requirements to mensurate on the received image chip. It is expected that the ICHIPA extension will be populated in addition to the normal complement of SDE extensions.

RULER mensuration uses the line and sample-indexing scheme of the original image to determine various geospatial measurements and position within an image, be it the original image or a chip of the original image. ICHIPA captures image chip corner point coordinate information that is mapped to the original image coordinate system as shown in figure 5-1. The mapping function is the result of a linear interpretation between image corner points and as such, can be assumed for only the simple linear (nondewarped) processed imagery.

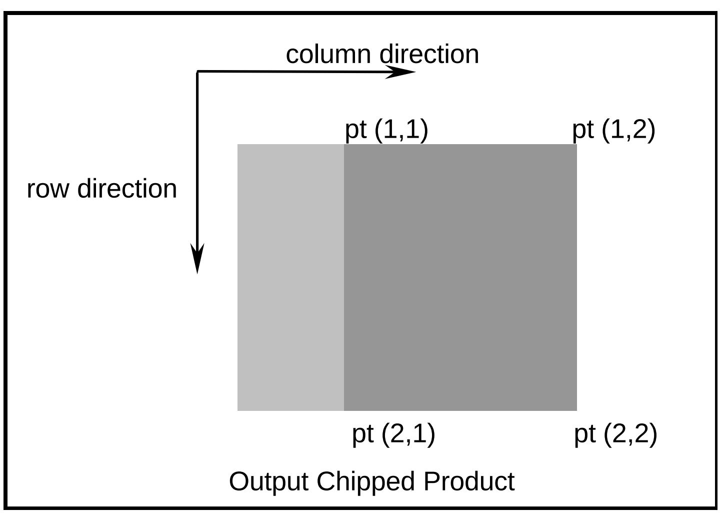

FIGURE 5-1. IMAGE CHIP CORNER COORDINATE

The reason for this is twofold. First, few systems today process non-dewarped imagery and even fewer can mensurate and calculate geo-positions from dewarped imagery. Second, due to the complexity of the algorithms that derive line and sample corner points and offset data, as well as the required processing power required, standardization of the algorithms for the community would be difficult. Therefore, standardizing the linear transformation, a straightforward process, is an appropriate baseline for ICHIPA.

In addition, a new tag or a revision to ICHIPA is recommended for more complex mensuration requirements. This is because the current tag is not sufficient for addressing dewarp scenarios.

To maintain interoperability within USIGS, ICHIPA should be included with all non-dewarped NITF chips, specifically when the chip is disseminated. It is recommended that it not be included with dewarped images.

5.3 FORMAT

The ICHIPA controlled tag provides the data needed to mensurate and calculate geo-positions of features on chips. This tag provides the output product row and column data for the image, as well as those data points referenced back to values for the original full image. For this tag, the original line and sample will be provided at the four corners of the significant image data.

ICHIPA Version 1.0 represents a major simplification of I2MAPD pertaining to dewarped (non-linear) capabilities. For example, the previously existing grid overlay has been deleted. As such, ICHIPA deals only with linear situations where only the four line and sample “original” product coordinates are considered. Thus, there is no need for n^{th} order polynomials and the tag length is fixed at 208 bytes. On the other hand, several existing features have been retained such as the non-linear transformation flag, which indicates whether the associated image is dewarped or not, and the anamorphic correction indicator. The scan block number is added to reflect comments received from the user community.

The tagged record fields for the ICHIPA extension are specified in tables 5-1, 5-2, and 5-3.

TABLE 5-1. ICHIPA TAGGED RECORD SUBHEADER FIELDS

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type Identifier	6	ICHIPA	R
CEL	Length of CEDATA Field	5	00208	R
CEDATA	User-Defined Data	208	table 5-2	R

TABLE 5-2. ICHIPA USER-DEFINED FIELD FORMAT

FIELD	NAME	SIZE	VALUE RANGE	TYPE
XFRM_ FLAG	Non-linear Transformation Flag	2	numeric 00 (nondewarped, data provided), 01 (no data provided)	R
SCALE_ FACTOR	Scale Factor Relative to R0 (original full image resolution)	10	numeric (typically reciprocal of display magnification) xxxx.xxxxx	R
ANAMRPH_CORR	Anamorphic Correction Indicator	2	numeric (00 or 01)	R

TABLE 5-2. ICHIPA USER-DEFINED FIELD FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
SCANBLK_NUM	Scan Block Number (scan block index)	2	00 to 99 00 if not applicable	R
OP_ ROW_11	Output product Row number component of grid point index (1,1) for significant data	12	numeric xxxxxxxx.yyy (typically 00000000.500)	R
OP_ COL_11	Output product Column number component of grid point index (1,1) for significant data	12	numeric xxxxxxxx.yyy (typically 00000000.500)	R
OP_ ROW_12	Output product Row number component of grid point index (1,2) for significant data	12	numeric xxxxxxxx.yyy	R
OP_ COL_12	Output product Column number component of grid point index (1,2) for significant data	12	numeric xxxxxxxx.yyy	R
OP_ ROW_21	Output product Row number component of grid point index (2,1) for significant data	12	numeric xxxxxxxx.yyy	R
OP_ COL_21	Output product Column number component of grid point index (2,1) for significant data	12	numeric xxxxxxxx.yyy	R
OP_ ROW_22	Output product Row number component of grid point index (2,2) for significant data	12	numeric xxxxxxxx.yyy	R
OP_ COL_22	Output product Column number component of grid point index (2,2) for significant data	12	numeric xxxxxxxx.yyy	R
FI_ ROW_11	Grid point (1,1), Row number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ COL_11	Grid point (1,1), Column number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ ROW_12	Grid point(1,2), Row number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ COL_12	Grid point(1,2), Column number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ ROW_21	Grid point (2,1), Row number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ COL_21	Grid point (2,1), Column number in full image coordinate system	12	numeric xxxxxxxx.yyy	R
FI_ ROW_22	Grid point (2,2), Row number in full image coordinate system	12	numeric xxxxxxxx.yyy	R

TABLE 5-2. ICHIPA USER-DEFINED FIELD FORMAT (CONTINUED).

FIELD	NAME	SIZE	VALUE RANGE	TYPE
FI_ COL_22	Grid point (2,2), Column number in full image coordinate system	12	numeric xxxxxxxx.yyy	R

Notes: (1) Row and column indexing, NITF nomenclature, corresponds to line and sample indexing in original product nomenclature.

(2) If XFRM_FLAG is 01, then remaining values will be zero fills.

TABLE 5-3. ICHIPA USER-DEFINED FIELD DEFINITIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
XFRM_FLAG	Non-linear Transformation Flag. If image is nondewarped, field is 00. For all others, flag is 01 with zero fills in the remaining fields.
SCALE_FACTOR	Scale Factor relative to the full image resolution R0. This provides a mechanism to reference back to the full image if product is not at R0. To determine product RRDS value: if 0001.00000 then 00; 0002.00000 then 01; 0004.00000 then 02; 0008.00000 then 03; 0016.00000 then 04; 0032.00000 then 05; 0064.00000 then 06; 0128.00000 then 07
ANAMRPH_CORR	If no anamorphic correction, 00; otherwise 01
SCANBLK_NUM	Scan block number from which the product was chipped if applicable; otherwise 00
OP_ROW_11	Output product row number component of grid point index (1,1) for significant data. Typically 00000000.500
OP_COL_11	Output product column number component of grid point index (1,1) for significant data. Typically 00000000.500
OP_ROW_12	Output product row number component of grid point index (1,2) for significant data.
OP_COL_12	Output product column number component of grid point index (1,2) for significant data.
OP_ROW_21	Output product row number component of grid point index (2,1) for significant data.
OP_COL_21	Output product column number component of grid point index (2,1) for significant data.
OP_ROW_22	Output product row number component of grid point index (2,2) for significant data.
OP_COL_22	Output product column number component of grid point index (2,2) for significant data.
FI_ROW_11	Grid point (1,1) row number in full image coordinate system.
FI_COL_11	Grid point (1,1) column numbers in full image coordinate system.
FI_ROW_12	Grid point (1,2) row number in full image coordinate system.
FI_COL_12	Grid point (1,2) column numbers in full image coordinate system.
FI_ROW_21	Grid point (2,1) row number in full image coordinate system.
FI_COL_21	Grid point (2,1) column numbers in full image coordinate system.
FI_ROW_22	Grid point (2,2) row number in full image coordinate system.
FI_COL_22	Grid point (2,2) column numbers in full image coordinate system.

6.0 PROFILE FOR IMAGERY ACCESS IMAGE SUPPORT EXTENSIONS

6.1 PIAE 1.0 - VERSION C

This support extension is designed to provide an area to place fields not currently carried in NITF but are contained in the Standards Profile for Imagery Access (SPIA). Most imagery related information is contained in the NITF main headers and Support Data Extensions (SDEs). The purpose of this extension is to minimize redundant fields while providing space for all information. This extension shall be present no more than once for each image in the NITF file. When present, this extension shall be contained within the image extended subheader data field of the image subheader or within an overflow DES if there is insufficient room to place the entire extension within the image extended subheader data field.

TABLE 6-1. PROFILE FOR IMAGERY ACCESS IMAGE (PIAIMC)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAIMC	R
CEL	Length Of PIAIMC Extension	5	00362	R
CEDATA	User-Defined Data	362	table 6-2	R

TABLE 6-2. PROFILE FOR IMAGERY ACCESS IMAGE (PIAIMC) DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
CLOUDCVR	Cloud Cover	3	N	000 to 100, 999	O
SRP	Standard Radiometric Product	1	A/N	Y, N	O
SENSMODE	Sensor Mode	12	A/N	WHISKBROOM, PUSHBROOM, FRAMING, SPOT, SWATH, TBD	O
SENSNAME	Sensor Name	18	A/N	USIGS DM, SENSOR - TYPE Name	O
SOURCE	Source	255	A/N	alphanumeric	O
COMGEN	Compression Generation	2	N	00 to 99	O
SUBQUAL	Subjective Quality	1	A/N	P-Poor, G - Good, E - Excellent, F- Fair	O
PIAMSNNUM	PIA Mission Number	7	A/N	EARS 1.1 page 4-28	O
CAMSPECS	Camera Specs	32	A/N	alphanumeric	O
PROJID	Project ID Code	2	A/N	EARS Appendix 9	O
GENERATION	Generation	1	N	0 to 9	O
ESD	Exploitation Support Data	1	A/N	Y, N	O
OTHERCOND	Other Conditions	2	A/N	EARS 1.1 page 4 to 28	O
MEAN GSD	MEANGSD	7	N	00000.0 to 99999.9 Expressed in inches, accuracy=10%	O

TABLE 6-2. PROFILE FOR IMAGERY ACCESS IMAGE (PIAIMC) DATA AND RANGES (CONTINUED).

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
IDATUM	Image Datum	3	A/N	Horizontal_Reference_ Datum_Code (refer to DDDS element	O
IELLIP	Image Ellipsoid	3	A/N	DIGEST, Part 3, table 8-1	O
PREPROC	Image Processing Level Code	2	A/N	USIGS DM, IMAGE-DATASET Processing Level Code	O
IPROJ	Image Projection System	2	A/N	DIGEST, Part 3, table 6-1	O
SATTRACK	Satellite Track	8	N	Minimum values: PATH(J)=0001 ROW(K)=0001 Maximum values: PATH(J)=9999 ROW(K)=9999 Recorded as PATH/ROW=00010001 to 99999999	O

TABLE 6-3. DESCRIPTION OF PIAIMC DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CLOUDCVR	Indicates the percentage of the image that is obscured by cloud. A value of 999 indicates an unknown condition.
SRP	Indicates whether or not standard radiometric product data is available.
SENSMODE	Identifies the sensor mode used in capturing the image.
SENSNAME	Identifies the name of the sensor used in capturing the image.
SOURCE	Indicates where the image came from (e.g., magazine, trade show, etc.).
COMGEN	Counts the number of lossy compressions done by the archive.
SUBQUAL	Indicates a subjective rating of the quality of the image.
PIAMSNNUM	Indicates the mission number assigned to the reconnaissance mission.
CAMSPECS	Specifies the brand name of the camera used, and the focal length of the lens.
PROJID	Identifies collection platform project identifier code.
GENERATION	Specifies the number of image generations of the product. The number (0) is reserved for the original product.
ESD	Indicates whether or not Exploitation Support Data is available and contained within the product data.
OTHERCOND	Indicates other conditions that affect the imagery over the target.
MEANGSD	The geometric mean of the across and along scan center-to-center distance between contiguous ground samples.

TABLE 6-3. DESCRIPTION OF PIAIMC DATA FIELDS (CONTINUED).

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
IDATUM	Identifies the mathematical representation of the earth used to geo-correct/or to rectify the image. (Identifies the Datum associated with IGEOLO.)
IELLIP	Identifies the mathematical representation of the earth used to geo-correct/or to rectify the image. (Identifies the Ellipsoid associated with IGEOLO.)
PREPROC	Identifies the level of radiometric and geometric processing applied to the product by the commercial vendor.
IPROJ	Identifies the 2D-map projection used by commercial vendors to geo-correct/or to rectify the image.
SATTRACK	Identifies location of an image acquired by LANDSAT or SPOT (only) along the satellite path.

6.2 PROFILE FOR IMAGERY ACCESS PRODUCT SUPPORT EXTENSION - VERSION D

The data found in the Product Support Extension addresses information regarding the products derived from source imagery. While there is product-related data in the NITF main header and SDEs, many fields contained in the Standards Profile for Imagery Access (SPIA) are absent. This extension aligns the SPIA and NITF for product information, and adds descriptive detail associated with products. This extension shall be present no more than once for each product. When present, this extension shall be contained within the extended header data field of the NITF file header or within an overflow DES if there is insufficient room to place the entire extension within the file's extended header data field.

TABLE 6-4. PROFILE FOR IMAGERY ACCESS PRODUCT (PIAPRD)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAPRD	R
CEL	Length Of PIAPRD Extension	5	00201 to 63759	R
CEDATA	User-Defined Data	201 to 63759	table 6-5	R

TABLE 6-5. PIAPRD DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
ACCESSID	Access ID	64	A/N	alphanumeric	O
FMCONTROL	FM Control Number	32	A/N	alphanumeric	O
SUBDET	Subjective Detail	1	A/N	P- Poor, F - Fair, G - Good, E - Excellent	O
PRODCODE	Product Code	2	A/N	EARS 1.1 Appendix 6	O
PRODUCERSE	Producer Supplement	6	A/N	alphanumeric	O
PRODIDNO	Product ID Number	20	A/N	alphanumeric	O
PRODSNME	Product Short Name	10	A/N	alphanumeric	R
PRODUCERCD	Producer Code	2	A/N	alphanumeric	O
PRODCRTIME	Product Create Time	14	A/N	CCYYMMDDHHMMSS (ZULU)	O
MAPID	Map ID	40	A/N	alphanumeric	O
SECTITLEREP	SECTITLE Repetitions	2	N	00 to 99	R
SECTITLE1	Section Title	40	A/N	alphanumeric	C
PPNUM1	Page/Part Number	5	A/N	alphanumeric	C
TPP1	Total Pages/Parts	3	N	001 to 999	C
....					
SECTITLEnn	Section Title	40	A/N	alphanumeric	C
PPNUMnn	Page/Part Number	5	A/N	alphanumeric	C

TABLE 6-5. PIAPRD DATA AND RANGES (CONTINUED)

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TPPnn	Total Pages/Parts	3	N	001 to 999	C
REQORGREP	REQORG Repetitions	2	N	00 to 99	R
REQORG1	Requesting Organization	64	A/N	alphanumeric	C
....					
REQORGnn	Requesting Organization	64	A/N	alphanumeric	C
KEYWORDREP	KEYWORD Repetitions	2	N	00 to 99	R
KEYWORD1	Keyword String 1	255	A/N	alphanumeric	C
....					
KEYWORDnn	Keyword String nn	255	A/N	alphanumeric	C
ASSRPTREP	ASSRPT Repetitions	2	N	00 to 99	R
ASSRPT1	Associated Report 1	20	A/N	alphanumeric	C
....					
ASSRPTnn	Associated Report nn	20	A/N	alphanumeric	C
ATEXTREP	ATEXT Repetitions	2	N	00 to 99	R
ATEXT1	Associated Text 1	255	A/N	alphanumeric	C
....					
ATEXTnn	Associated Text nn	255	A/N	alphanumeric	C

TABLE 6-6. DESCRIPTION OF PIAPRD DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ACCESSID	Contains an archive unique identifier. This could be the product filename, a record identifier, a reference number, the product id, or any other means to access the product from the archive.
FM CONTROL	Identifies foreign material associated with the product.
SUBDET	Indicates a subjective rating of useful detail available in the product.
PRODCODE	Identifies the category of product data stored in the archive.
PRODUCERSE	Identifies the element within the producing organization that created the product.
PRODIDNO	Identifies a product stored in the archive with a producer assigned number.
PRODSNME	Identifies the abbreviated name of a product stored in the archive.
PRODUCERCD	Identifies the organization responsible for creating or modifying the product.
PRODCRTIME	Identifies the date or the date and time that the product was created or last modified, expressed in ZULU time

TABLE 6-6. DESCRIPTION OF PIAPRD DATA FIELDS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MAPID	Identifies a map associated with the product.
SECTITLEREP	Identifies the number of times the SECTITLE, PPNUM, and TPP fields repeat per extension instance.
SECTITLE1	Identifies the first user defined title of a section of a multi-section product.
PPNUM1	Identifies the first page/part number of the section identified in SECTITLE1.
TPP1	Identifies the total number of pages or parts associated with SECTITLE1 and PPNUM1.
SECTITLEnn	Identifies the nnth user defined title of a section of a multi-section product.
PPNUMnn	Identifies the nnth page/part number of the section identified in SECTITLEnn.
TPPnn	Identifies the nnth number of pages or parts associated with SECTITLEnn and PPNUMnn.
REQORGREP	Identifies the number of times the REQORG field repeats per extension instance.
REQORG1	Identifies the first organization requesting that an image be placed in an archive. This is the first field represented based on the value of REQORGREP.
REQORGnn	Identifies the nnth organization requesting that an image be placed in an archive. The number of REQORGs between the previous field and this is represented in the REQORGREP field.
KEYWORDREP	Identifies the number of times the KEYWORD field repeats per extension instance.
KEYWORD1	Provides the first block of a freeform text description of the product.
KEYWORDnn	Provides the nnth block of a freeform text description of the product. The number of KEYWORDSs between the previous field and this is represented in the KEYWORDREP field.
ASSRPTREP	Identifies the number of times the ASSRPTREP field repeats per extension instance.
ASSRPT1	First field for the entry of another known report associated with the product.
ASSRPTnn	Provides the nnth field of other known reports associated with the product. The number of ASSRPTs between the previous field and this is represented in the ASSRPTREP field.
ATEXTREP	Identifies the number of times the ATEXTREP field repeats per extension instance.
ATEXT1	Provides the first text block further describing the imagery product.
ATEXTnn	Provides the nnth text block further describing the imagery product. The number of ATEXTs between the previous field and this is represented in the ATEXTREP field.

6.3 PROFILE FOR IMAGERY ACCESS TARGET SUPPORT EXTENSION - VERSION B

The Target Extension is designed to accommodate more than just the essential target data. It contains descriptive data about the targets. This extension shall be present once for each target identified in the image. There may be up to 250 of these extensions for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 6-7. PROFILE FOR IMAGERY ACCESS TARGET (PIATGB)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIATGB	R
CEEL	Length of PIATGB Extension	5	000117	R
CEDATA	User-Defined Data	117	table 6-8	R

TABLE 6-8. PIATGB DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TGTUTM	Target UTM	15	A/N	XXXNNnnnnnnnnnn	O
PIATGAID	Target Identification	15	A/N	6 character Area Target ID 10 Character BE, or 15 character BE + suffix	O
PIACTRY	Country Code	2	A/N	FIPS 10-4	O
PIACAT	Category Code	5	N	DIAM 65-3-1	O
TGTGEO	Target Geographic Coordinates	15	A/N	ddmmssXdddmmssY	O
DATUM	Target Coordinate Datum	3	A/N	In accordance with Appendix B, Attachment 10, XI-DBDD-08 93 Aug 93.	O
TGTNAME	Target Name	38	A/N	alphanumeric target names	O
PERCOVER	Percentage of Coverage	3	N	000 to 100	O
TGTLAT	Target Latitude	10	N	±dd.dddddd - where "+" is northern hemisphere and "-" is southern hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be blank.	O

TABLE 6-8. PIATGB DATA AND RANGES (CONTINUED)

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
TGTLON	Target Longitude	11	N	±ddd.dddddd - where "+" is eastern hemisphere and "-" is western hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be blank.	O

TABLE 6-9. DESCRIPTION OF PIATGB DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
TGTUTM	Identifies the Universal Transverse Mercator (UTM) grid coordinates that equate to the geographic coordinates of the target element.
PIATGAID	Identifies a point or area target (DSA, LOC or BAS).
PIACTRY	Identifies the country in which the geographic coordinates of the target element reside.
PIACAT	Classifies a target element by its product or the type of activity in which it can engage.
TGTGEO	Specifies a point target's geographic location in latitude and longitude.
DATUM	Identifies the datum of the map used to derive the target coordinates (UTM or GEO).
TGTNAME	Identifies the official name of the target element based on the MIIDS/IDB name.
PERCOVER	Percentage of the target covered by the image.
TGTLAT	Specifies a point target's geographic location in latitude (in decimal degrees).
TGTLON	Specifies a point target's geographic location in longitude (in decimal degrees).

6.4 PROFILE FOR IMAGERY ACCESS PERSON IDENTIFICATION EXTENSION - VERSION B

The Person Extension is designed to identify information contained in the Imagery Archive that is directly related to a person(s) contained in a data type (image, symbol, label, and text). This extension shall be present for each person identified in a data type. There may be up to 500 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 6-10. PROFILE FOR IMAGERY ACCESS PERSON (PIAPEB)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAPEB	R
CEL	Length of PIAPEB Extension	5	00094	R
CEEDATA	User-Defined Data	94	table 6-11	R

TABLE 6-11. PIAPEB DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
LASTNME	Last Name	28	A/N	alphanumeric	O
FIRSTNME	First Name	28	A/N	alphanumeric	O
MIDNME	Middle Name	28	A/N	alphanumeric	O
DOB	Birth Date	8	A/N	CCMMDDYY	O
ASSOCTRY	Associated Country	2	A/N	Per FIPS 10-4	O

TABLE 6-12. DESCRIPTION OF PIAPEA DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
LASTNME	Identifies the surname of individual captured in an image.
FIRSTNME	Identifies the first name of individual captured in an image.
MIDNME	Identifies the middle name of individual captured in an image.
DOB	Identifies the birth date of the individual captured in the image.
ASSOCTRY	Identifies the country the person captured in the image is/are associated with.

6.5 PROFILE FOR IMAGERY ACCESS EVENT EXTENSION - VERSION A

The Event Extension is designed to provide an area for specific information about an event or events that are identified on an image. This extension shall be present for each event identified in an image. There may be up to 100 of these extensions present for each data type in a NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 6-13. PROFILE FOR IMAGERY ACCESS EVENT (PIAEVA)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAEVA	R
CEL	Length of PIAEVA Extension	5	00046	R
CEDATA	User-Defined Data	46	table 6-14	R

TABLE 6-14. PIAEVA DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
EVENTNAME	Event Name	38	A/N	alphanumeric	O
EVENTTYPE	Event Type	8	A/N	POL, DIS, COMMO, MILEX, ECON, NUC, SPACE, MILMOV, CIVIL	O

TABLE 6-15. DESCRIPTION OF PIAEVA DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
EVENTNAME	The recognized name of the event.
EVENTTYPE	Indicates the generic type of event associated with the product.

6.6 PROFILE FOR IMAGERY ACCESS EQUIPMENT EXTENSION - VERSION A

The Equipment Extension was created to provide space in the NITF file for data contained in the archive that is specifically related to equipment that is contained in an image. This extension shall be present for each instance of equipment identified in an image. There may be up to 250 occurrences of this extension for each data type in an NITF file. When present, these extension(s) shall be contained within the appropriate data type (image, symbol, label or text) extended subheader data field of the data type subheader or within an overflow DES if there is insufficient room to place the entire extension(s) within the data type extended subheader data field.

TABLE 6-16. PROFILE FOR IMAGERY ACCESS EQUIPMENT (PIAEQA)

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type ID	6	PIAEQA	R
CEL	Length of PIAEQA	5	00130	R
CEDATA	User-Defined Data	130	table 6-17	R

TABLE 6-17. PIAEQA DATA AND RANGES

FIELD	NAME	SIZE	FMT	VALUE RANGE	TYPE
EQPCODE	Equipment Code	7	A/N	NGIC Foreign Equipment Guide	O
EQPNOMEN	Equipment Nomenclature	45	A/N	NGIC Foreign Equipment Guide	O
EQPMAN	Equipment Manufacturer	64	A/N	alphanumeric	O
OBTYPE	OB Type	1	A/N	MIIDS/IDB	O
ORDBAT	Type Order of Battle	3	A/N	EARS 1.1	O
CTRYPROD	Country Produced	2	A/N	FIPS 10-4	O
CTRYDSN	Country Code Designed	2	A/N	FIPS 10-4	O
OBJVIEW	Object View	6	A/N	Right, Left, Top, Bottom, Front, Rear	O

TABLE 6-18. DESCRIPTION OF PIAEQA DATA FIELDS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
EQPCODE	A unique designated equipment code identifying a category of equipment.
EQPNOMEN	Nomenclature used to identify a piece of equipment.
EQPMAN	Identifies the manufacturer of a piece of equipment.
OBTYPE	Indicates the type of order of battle according to MIIDS/IDB
ORDBAT	Indicates the type of order of battle according to EARS 1.1
CTRYPROD	Identifies the country that produced the object
CTRYDSN	Identifies the country that designed the original object
OBJVIEW	View of the object.

6.7 IMAGE ACCESS DATA ELEMENT MAPPING TO NITF

The following table maps all Imagery Access data elements to their proper location in a NITF file when transmitting imagery data and associated metadata.

TABLE 6-19. IMAGE ACCESS DATA ELEMENT MAPPING TO NITF

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
ABPP (N2)	ABPP	IMAGE SUBHEADER
ACCESSID (A/N64)	ACCESSID	PIAPRC, PIAPRD
ANGLETONORTH (N3)	ANGLE_TO_NORTH	USEN1A, USEN2A, USEN2B, EXPLTA, EXQPTA, USE00A
ASSOCTRY (A2)	ASSOCTRY	PIAPEA, PIAPEB
ASSRPT (A/N20)	ASSRPT	PIAPRC, PIAPRD
ATEXT (A/N255)	ATEXT	PIAPRC, PIAPRD
AUTHORITY (A/N20) ATUHORITY (A/N40)	FSCAUT (2500A) FSCAUT (2500B)	HEADER
AUTHTYP (A/N 1)	FSCATP (2500B)	HEADER
CAMSPECS (A/N 32)	CAMSPECS	PIAIMB, PIAIMC
CAT (N5)	PIACAT	PIATGA, PIATGB
CLASS (A1)	FSCLAS	HEADER
CLASSRSN (A/N 1)	FSCRSN (2500B)	HEADER
CLASSYS (A/N 2)	FSCLSY (2500B)	HEADER
CLASTXT (A/N 44)	FSCLTX (2500B)	HEADER
CLEVEL (N2)	CLEVEL	HEADER
CLOUDCVR (N3)	CLOUDCVR	PIAIMB, PIAIMC
CODEWORDS (A/N40) CODEWORDS (A/N11)	FSCODE (2500A) FSCODE (2500B)	HEADER
COMGEN (N2)	COMGEN	PIAIMB, PIAIMC
CONTROL (A/N40) CONTROL (A/N2)	FSCTLH (2500A) FSCTLH (2500B)	HEADER
CTRYCD (A2)	PIACTRY	PIATGA, PIATGB
CTRYDSN (A2)	CTRYDSN	PIAEQA
CTRYPROD (A2)	CTRYPROD	PIAEQA
DATUM (A3)	DATUM	PIATGA, PIATGB
DOB (A/N6) DOB (A/N8)	DOB DOB	PIAPEA PIAPEB
DWNG (A/N6)	FSDDVT (2500A)	HEADER
WNGFEVT (A/N40)	FSDEVT (2500A)	HEADER
DECLASTYP (A/N 2)	FSDCTP (2500B)	HEADER
DECLASSDTE (A/N 8)	FSDCDT (2500B)	HEADER
DECLASXMP (A/N 4)	FSDCXM (2500B)	HEADER
DWNGRD (A/N 1)	FSDG (2500B)	HEADER
DWNDTE (A/N 8)	FSDGDT (2500B	HEADER
EQPCODE (A/N7)	EQPCODE	PIAEQA
EQPMAN (A64)	EQPMAN	PIAEQA

TABLE 6-19. IMAGE ACCESS DATA ELEMENT MAPPING TO NITF (CONTINUED)

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
EQPNOMEN (A/N45)	EQPNOMEN	PIAEQA
ESD (A1)	ESD	PIAIMB, PIAIMC
EVENTNAME (A/N38)	EVENTNAME	PIAEVA
EVENTTYPE (A8)	EVENTTYPE	PIAEVA
FCNTLNR (A/N15)	FSCTLN (2500B)	HEADER
FIRSTNME (A/N 28)	FIRSTNME	PIAPEA, PIAPEB
FMCONTROL(A/N32)	FMCONTROL	PIAPRC, PIAPRD
GENERATION(N1)	GENERATION	PIAIMB, PIAIMC
ICAT(A8)	ICAT	IMAGE SUBHEADER
ICORDS (A1)	ICORDS	IMAGE SUBHEADER
ICRNPTS (N84)	IGEOLO (TRUNCATED TO N60)	IMAGE SUBHEADER
IDATUM (A/N3)	IDATUM	PIAIMC
IELLIP (A/N3)	IELLIP	PIAIMC
IGEOLO (A/N60)	IGEOLO	IMAGE SUBHEADER
IMAGEID (A/N80)	ITITLE	IMAGE SUBHEADER
IPROJ (A/N2)	IPROJ	PIAIMC
IREP (A8)	IREP	IMAGE SUBHEADER
KEYWORD (A/N 255)	KEYWORD	PIAPRC, PIAPRD
LASTNME (A/N28)	LASTNME	PIAPEA, PIAPEB
LICENSE (A/N50)	ICOM (License values will be transmitted in the first 50 bytes of the comments field)	IMAGE SUBHEADER
MAPID (A/N40)	MAPID	PIAPRC, PIAPRD
MEANGSD (N5) MEANGSD (N7)	MEAN_GSD MEAN_GSD	USEN1A, EXOPTA, USE00A PIAIMC
MIDNME (A/N28)	MIDNME	PIAPEA, PIAPEB
MISSION (A/N7)	PIAMSNNUM	PIAIMB, PIAIMC
NBANDS (N1) NBANDS (N5)	NBANDS (2500A) XBANDS (2500B)	IMAGE SUBHEADER
NCOLS (N8)	NCOLS	IMAGE SUBHEADER
NIIRS (N3)	NIIRS NRIS	USEN1A IMBLKA, IMBLKB
NROWS (N8)	NROWS	IMAGE SUBHEADER
OBJVIEW (A6)	OB~~B~~JVIEW	PIAEQA
OBLANGLE (N5)	OBL_ANG	USEN1A, EXOPTA, USEOOA
OBTYPE (A1)	OBTYPE	PIAEQA
ORDBAT(A/N3)	ORDBAT	PIAEQA
OTHERCOND (A2)	OTHERCOND	PIAIMB, PIAIMC
PERCOVER (N3)	PERCOVER	PIATGA, PIATGB

TABLE 6-19. IMAGE ACCESS DATA ELEMENT MAPPING TO NITF (CONTINUED)

SPIA ELEMENT	NITF ELEMENT	NITF LOCATION
PLATID (A/N14)	MISSION	STDIDC
PPNUM (A/N4)	PPNUM	PIAPRC, PIAPRD
PREPROC (A/N2)	PREPROC	PIAIMC
PRODCODE (A2)	PRODCODE	PIAPRC, PIAPRD
PRODCRTIME (A/N14)	PRODCRTIME	PIAPRC, PIAPRD
PRODFMT(A9)	FHDR	HEADER
PRODFSIZE (N12)	FL	HEADER
PRODIDNO (A/N20)	PRODIDNO	PIAPRC, PIAPRD
PRODSNME (A/N10)	PRODSNME	PIAPRC, PIAPRD
PRODTITLE (A/N50)	FTITLE	HEADER
PRODUCERCD (A 2)	PRODUCERCD	PIAPRC, PIAPRD
PRODUCERSE (A/N 6)	PRODUCERSE	PIAPRC, PIAPRD
PROJID (A2)	PROJID	PIAIMB, PIAIMC
RELEASE (A/N40)	FSREL	HEADER
REQORG (A/N64)	REQORG	PIAPRC, PIAPRD
RPC (A1)	SUCCESS	RPC00A
SATTRACK	SATTRACK	PIAIMC
SECTITLE (A/N40)	SECTITLE	PIAPRC, PIAPRD
SENSMODE (A/N12)	SENSMODE	PIAIMB, PIAIMC
SENSNAME (A/N18)	SENSNAME	PIAIMB, PIAIMC
SOURCE (A/N255)	SOURCE	PIAIMB, PIAIMC
SRCDTE	FSSRDT (2500B)	HEADER
SRP (A1)	SRP	PIAIMB, PIAIMC
STEREOID (A/N40) STEREOID (A/N60)	ST_ID ST_ID	STREOA STREOB, STEROB
SUBDET (A1)	SUBDET	PIAPRC, PIAPRD
SUBQUAL (A1)	SUBQUAL	PIAIMB, PIAIMC
SUNAZ(N3)	SUN_AZ	MPDN1A, USE00A, EXOPTA
SUNELEV (N3)	SUN_EL	MPDN1A, USE00A, EXOPTA
TGTGEO (A/N15)	TGTGEO	PIATGA, PIATGB
TGTID (A/N15)	PIATGAID	PIATGA, PIATGB
TGTLAT (N10)	TGTLAT	PIATGB
TGTLON (N11)	TGTLON	PIATGB
TGTNAME (A/N38)	TGTNAME	PIATGA
TGTUTM (A/N16)	TGTUTM	PIATGA
TIMECOLL (A/N14)	IDATIM	IMAGE SUBHEADER
TPP (N3)	TPP	PIAPRC, PIAPRD

7.0 COMMERCIAL SUPPORT DATA EXTENSION (SDE)

7.1 GENERIC TAGGED EXTENSION MECHANISM

The tagged record extensions defined in this document are CEs as defined in Section 5.9 of the NITF 2.0 document. The CE format is summarized here for ease of reference. Tables 7-1 and 7-2 describe the general format of a CE. NOTE: All blanks or spaces in this document are defined as ASCII spaces (i.e. hex '20') and are used interchangeably.

TABLE 7-1 CONTROLLED TAGGED RECORD EXTENSION FORMAT
R = required, C = conditional

FIELD	NAME	SIZE	VALUE RANGE	TYPE
CETAG	Unique Extension Type Identifier	6	alphanumeric	R
CEL	Length of CEDATA Field	5	00001 to 99985	R
CEDATA	User-Defined Data	†	User-defined	R

† Equal to value of CEL field

All fields of all of the tags defined within this section are of type "Required".

TABLE 7-2 CONTROLLED TAGGED RECORD EXTENSION FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain a valid alphanumeric identifier properly registered with the NTB.
CEL	This field shall contain the length in bytes of the data contained in CEDATA. The tagged record's length is 11+ the value of CEL.
CEDATA	This field shall contain data of either binary or character data types defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user-defined.

The CETAG and CEL fields essentially form a small (11 byte) tagged record subheader. The format and meaning of the data within the CEDATA field is the subject of this section for several, individual CEs.

Multiple tagged extensions can exist within the TRE area. There are several such areas, each of which can contain up to 99,999 bytes worth of tagged extensions. There is also an overflow mechanism, should the sum of all tags in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of tags. Figure 7-1 shows a diagram of the tagged extension locations within the NITF 2.0 file structure.

While the extensions defined in this document will typically be found in the image subheader, it is possible that they could appear in a DES that is being used as an overflow of the image subheader.

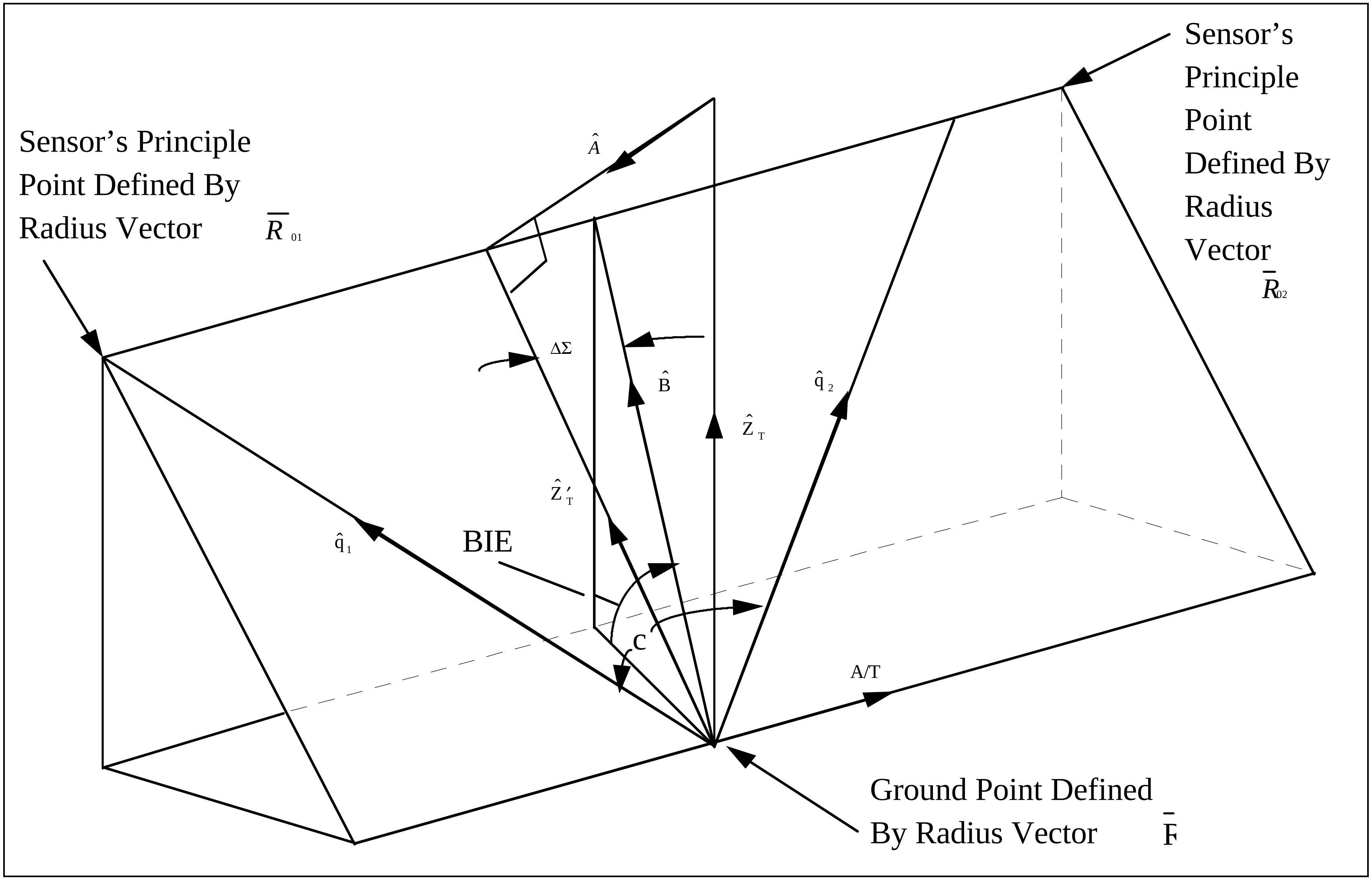

FIGURE 7-1. ILLUSTRATION OF ANGLES INVOLVED IN STEREO IMAGERY

7.2 STDIDC - STANDARD ID

The Standard ID extension contains image identification data that supplements the image subheader. Some parameters in this extension may be used by USIGS compliant systems. The format and description for the user-defined fields of the STDIDC extension are detailed in table 7-3. A single STDID is placed in the image subheader; where several images relate to a single scene; an STDIDC may be placed in each applicable image subheader. Note: The fields ACQUISITION_DATE through END_ROW constitute an image ID which is used by other SDEs (e.g., STREOB) to designate unique images for associating imagery pairs or sets.

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT

R = Required, C = Conditional, <> = null data allowed.

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
CETAG	Unique Extension Identifier	6	STDIDC	N/A	R
CEL	Length of Data Field	5	00089	bytes	R
The following fields define STDIDC					
ACQUISITION_DATE	Acquisition Date. This field shall contain the date of the collection mission (date of aircraft takeoff) in the format YYYYMMDDHHMMSS, in which YYYY is the year, MM is the month (01 to 12), DD is the day of the month (01 to 31), HH is the hour (0 to 23), MM is the minute (0 to 59) and SS (00 to 59) is the second (00 to 59). The date changes at midnight UTC. This field is equivalent to the IDATIM field in the image subheader.	14	YYYYMMDDHHMMSS		R
MISSION	Mission Identification. Fourteen character descriptor of the vehicle. For satellite, identifies the specific vehicle as source of image data. For aerial, identifies the scanner.	14	alphanumeric Valid values as per list maintained by JITC		R
PASS	Pass Number. A number in the range 01 to 99 shall identify each pass or flight per day. In order to ensure uniqueness in the image id, if the satellite or aerial mission extends across midnight UTC, the pass number shall be 01 through 99 on images acquired before midnight UTC and Ax on images acquired after midnight UTC; for extended missions Bx, … Zx shall designate images acquired on subsequent days (where x is in the range of 0 to 9).	2	alphanumeric 01 to 99, A1 to A9 B1 to B9 … Z1 to Z9		R

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
OP_NUM	Image Operation Number. Imaging operations numbers shall increase within each Imaging System pass. A value of "000" indicates that the system does not number imaging operations. For video systems, this field will contain the frame number within the acquisition date and time.	3	000 to 999		R
START_SEGMENT	Start Segment ID Identifies images as separate pieces (segments) within an imaging operation. AA is first segment; AB is second segment, etc.	2	AA to ZZ		R
REPRO_NUM	Reprocess Number. This field indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A "00" in this field indicates that the data is an originally processed image, "01" indicates the first reprocess/enhancement, etc.	2	00 to 99		R
REPLAY_REGEN	Replay (remapping) imagery mode shall provide the capability to alter the digital processing of previously recorded digital imagery. Regen regeneration imagery mode provides the capability to produce an image identical to the image that was produced in initial process. The images are used as replacements for images damaged during production A "000" in this field indicates that the data is an originally processed image.	3	alphanumeric		R
BLANK_FILL	Blank Fill	1	blank or _		<R>
START_COLUMN	Starting Column Block. For tiled (blocked) sub-images, the starting column block is defined as the offset, in blocks, of the first block in the cross-scan direction relative to start of the original reference image tiling.	3	001 to 999		R

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
START_ROW	Starting Row Block. For tiled (blocked) sub-images, the starting row block is defined as the offset, in blocks, of the first block in the along-scan direction relative to start of the original reference image tiling.	5	00001 to 99999		R
END_SEGMENT	Ending Segment ID of this file	2	AA to ZZ		R
END_COLUMN	Ending Column Block. For tiled (blocked) sub-images, the ending column block is defined as the offset, in blocks, of the last block of the image in the cross-scan direction relative to start of the original reference image tiling.	3	001 to 999		R
END_ROW	Ending Row Block. For tiled (blocked) sub-images, the ending row block is defined as the offset, in blocks, of the last block in the along-scan direction relative to start of the original reference image tiling.	5	00001 to 99999		R
COUNTRY	Country Code. Two letter code defining the country for the reference point of the image. Standard codes may be found in FIPS PUB 10-4.	2	AA to ZZ		<R>
WAC	World Aeronautical Chart. 4 number World Aeronautical Chart for the reference point of the image segment. World Aeronautical Chart grids the earth into regions with a 4 number ID.	4	0001 to 1866		<R>

TABLE 7-3. USER-DEFINED FIELDS STDIDC ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNIT	TYPE
LOCATION	Location. The natural reference point of the sensor; provides a rough indication of geographic coverage. The format DDMMX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X = N or S for north or south, and DDMMY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y = E or W for east or west, respectively. For SAR imagery, the reference point is normally the center of the first image block. For EO-IR imagery, the reference point for framing sensors is the center of the frame; for continuous sensors, it is the center of the first line.	11	DDMMXDDDMMY		R
	reserved	5	spaces		<R>
	reserved	8	spaces		<R>

7.3 USE00A - EXPLOITATION USABILITY

The Exploitation Usability extension is intended to allow a user program to determine if the image is usable for the exploitation problem currently being performed. It also contains some catalogue metadata. The format and descriptions for the user-defined fields of the USE00A are detailed in table 7-4.

TABLE 7-4. USEOOA - EXPLOITATION USABILITY EXTENSION FORMAT
R = Required, C = Conditional, < > = null data allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	USEOOA	N/A	R
CEL	Length Data Fields	5	00107	bytes	R
The following fields define USE00A					
ANGLE_TO_NORTH	Angle to North. Angle to true north measured clockwise from first row of the image.	3	000 to 359	degrees	R
MEAN_GSD	Mean Ground Sample Distance. The geometric mean of the cross and along scan center-to-center distance between contiguous ground samples. Accuracy = ±10% Note: Systems requiring an extended range shall insert a default value of "000.0" for this field and utilize the PIAMC tag.	5	000.0 to 999.9	inches	R
	reserved	1	spaces		<R>
DYNAMIC_RANGE	Dynamic Range. Dynamic range of pixels in image.	5	00000 to 99999		<R>
	reserved	3	spaces		<R>
	reserved	1	spaces		<R>
	reserved	3	spaces		<R>
OBL_ANG	Obliquity Angle	5	00.00 to 90.00	degrees	<R>
ROLL_ANG	Roll Angle	6	±90.00	degrees	<R>
	reserved	12	spaces		<R>
	reserved	15	spaces		<R>
	reserved	4	spaces		<R>
	reserved	1	space		<R>
	reserved	3	spaces		<R>
	reserved	1	spaces		<R>
	reserved	1	space		<R>

TABLE 7-4. USE00A - EXPLOITATION USABILITY EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
N_REF	Number of Reference Lines. Number of reference lines in the image. For each reference line, there will be a REFLNA extension in the NITF file.	2	00 to 99		R
REV_NUM	Revolution Number. The revolution number in effect at the northernmost point of orbit.	5	00001 to 99999		R
N_SEG	Number of Segments	3	001 to 999		R
MAX_LP_SEG	Maximum Lines Per Segment. Maximum number of lines per segment, including overlap lines. The maximum number of lines per segment depends upon the aggregation mode of the collector.	6	000001 to 999999		<R>
	reserved	6	spaces		R
	reserved	6	spaces		R
SUN_EL	Sun Elevation. In degrees measured from the target plane at intersection of the optical line of sight with the earth's surface at the time of the first image line. Default value, if data is not available, is 999.9.	5	-90.0 to +90.0, or 999.9	degrees	R
SUN_AZ	Sun Azimuth. In degrees measured from true North clockwise (as viewed from space) at the time of the first image line. Default value, if data is not available, is 999.9.	5	000.0 to 359.0, or 999.9	degrees	R

7.4 STREOB - STEREO INFORMATION

The STREO extension provides links between several images that form a stereo set to allow exploitation of elevation information. There can be up to 3 STREO extensions per image. The format and descriptions for the User Defined fields of the STREOB extension is detailed in table 7-5. The Stereo geometry definitions for Bisector Elevation Angle (BIE), convergence angle, and asymmetry angle are specified in paragraph 2.3.1.

TABLE 7-5. STREOB - STEREO INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, < > = null data allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	STREOB	N/A	R
CEL	Length of Data Field	5	00094	bytes	R
The Following Fields Define STREOB :					
ST_ID	Stereo Mate. The image ID of the first stereo mate. The fields ACQUISITION_DATE through END_ROW in the STDIDC tag constitute the image ID.	60	alphanumeric	N/A	R
N_MATES	Number of Stereo Mates. If there are no stereo mates, there will not be any STREOB (TBR) extensions in the file. If there is a STREOB (TBR) extension, then there will be at least 1 stereo mate.	1	1 to 3	N/A	R
MATE_INSTANCE	Mate Instance identifies which stereo mate is described in that extension. For example, this field contains a 2 for the second stereo mate.	1	1 to 3	N/A	R
B_CONV	Beginning Convergence Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_CONV	Ending Convergence Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>

TABLE 7-5. STREOB - STEREO INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
B_ASYM	Beginning Asymmetry Angle defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
E_ASYM	Ending Asymmetry Angle defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	5	00.00 to 90.00	degrees	<R>
B_BIE	Beginning BIE less Convergence Angle of Stereo Mate, defined at the first lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the first line of the fore and the last line of the aft shall be used.	6	± 90.00	degrees	<R>
E_BIE	Ending BIE less Convergence Angle of Stereo Mate, defined at the last lines of the fore/left and aft/right images, unless those images are more than 90 degrees apart. If the images are more than 90 degrees apart, the last line of the fore and the first line of the aft shall be used.	6	± 90.00	degrees	<R>

7.5 STEREO GEOMETRY DEFINITIONS

Refer to figure 7-1. Stereo geometry is often described in terms of convergence angle and asymmetry angle at a ground point defined by radius vector $\overline{\mathrm{R}}$. These angles are measured in the plane formed by the two lines of sight (one for each image) to the ground point. Given the geocentric radius vectors to the sensor's principle point for the two images, $\overline{\mathrm{R}}_{01}$ and $\overline{\mathrm{R}}_{02}$, the two line of sight vectors to the ground point are given by:

$$\bar{L}_1 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{01}$$
$$\bar{L}_2 = \overline{\mathrm{R}} - \overline{\mathrm{R}}_{02}$$

Where all of the above vectors are defined in the S_E coordinate system. Let:

$$\hat{q}_1 = -\bar{L}_1 \ / \ |\bar{L}_1|$$

$$\hat{q}_2 = -\bar{L}_2 \ / \ |\bar{L}_2|$$

The convergence angle, C, is the angle between $\hat{q}_1$ and $\hat{q}_2$ and is given by:

$$C = \cos^{-1}(\hat{q}_1 \bullet \hat{q}_2), \quad 0 \le C \le p$$

The asymmetry angle, ✦▥, at a ground point is the angle between the projection of $\hat{Z}_T$ into the plane of the convergence angle and the bisector, B, of the convergence angle. $\hat{Z}_T$ is the ground geocentric "up" and is defined by geocentric radius vector $\bar{R}$,

$$\hat{Z}_T = \bar{R} \ / \ |\bar{R}|$$

Define vector $\hat{\mathrm{A}}$ perpendicular to the plane of the convergence defined by vectors $\hat{q}_1$ and $\hat{q}_2$. Then:

$$\hat{\mathrm{A}} = (\hat{q}_1 \times \hat{q}_2) / |\hat{q}_1 \times \hat{q}_2|$$

The unit vector along the projection of $\hat{Z}_T$ into the plane of the convergence, $\hat{Z}'_T$ is given by:

$$\hat{Z}'_T = \hat{A} \times (\hat{Z}_T \times \hat{A}) \ / \ |\hat{A} \times (\hat{Z}_T \times \hat{A})|$$

The unit vector along the bisector, $\hat{\mathrm{B}}$, of the convergence angle (the angle between $\hat{q}_1$ and $\hat{q}_2$) is given by:

$$\hat{B} = (\hat{q}_1 + \hat{q}_2) \ / \ |\hat{q}_1 + \hat{q}_2|$$

The asymmetry angle is computed by:

$$\Delta\Sigma = \cos^{-1}(\hat{\mathrm{B}} \bullet \hat{\mathrm{Z}}'_T), \quad 0 \le \Delta\Sigma \le p/2$$

If $\hat{\mathrm{Z}}'_T$ lies in the positive Along-Track (A/T) direction from $\hat{\mathrm{B}}$,

$$\hat{A} \bullet \left(\hat{Z}'_T \times \hat{B}\right) < 0$$

Note that figure 7-1 shows $\hat{Z}'_T$ in the minus A/T direction from $\hat{B}$. The elevation angle of the bisector of the Stereo Convergence Angle, BIE is given by:

$$BIE = \sin^{-1}\left(\hat{Z}_T \bullet \hat{B}\right)$$

7.6 EXPLOITATION AND MAPPING SUPPORT DATA (TBR)

The Exploitation and Mapping Support Data Extension will provide the necessary information to perform accurate geo-positioning and mensuration. The Government has agreed to provide resolution as to form and content.

Background. This data extension may be executed in either of two methods:

1) A Rational Polynomial Relating Position to Image Coordinates plus Associated Error Propagation

   - Candidate Models: RPC, Universal Math Model
   - Technique does require user to maintain proprietary sensor camera models
   - Issues with regard to accuracy, precision & error propagation to be addressed for mapping applications

2) Ephemeris-based Geo-positioning

   - Allows user to perform triangulation to determine location and associated errors
   - Requires use of rigorous projection models
   - Issues regarding:

     a) Maintenance of Camera Models for each sensor platform

     b) Proprietary Camera Models

     c) User System Implementation requires extensive documentation of camera models and ephemeris reduction techniques for each satellite sensor.

     d) Standard ephemeris data format for all commercial vehicles.

8.0 SYNTHETIC APERTURE RADAR (SAR) SDE

8.1 OVERVIEW

That set of support data needed to accomplish the mission of a system receiving a NITF 2.0 file is referred to as "appropriate" support data. The appropriate support data may vary across systems receiving NITF 2.0 files. A system receiving a NITF 2.0 file may add or subtract support data before passing the file to another system with a different mission. This strategy implies a modular support data definition approach.

8.1.1 SOURCES OF SUPPORT DATA

Image providers produce NITF 2.0 files with support data from other formats that also contain support information. The extensions described here define the format for that support information within a NITF 2.0 file containing SAR imagery.

8.1.2 DEFINED SUPPORT DATA EXTENSIONS

Table 8-1 lists the SDEs that are defined for use with processed SAR imagery. Several are similar to existing and proposed extensions developed by other related programs, and can be considered aliases to those extensions. Reserved data fields maintain alignment between the original and aliases extensions where original fields are not applicable to SAR imagery.

Each tag ends with the letter "A". Revised tags will have names ending in "B" ("C","D", etc.) as revisions are approved. A transition plan for implementing tag changes shall accompany any such revisions. Typically, receivers of NITF products should support both the “A” and “B” versions for some reasonable period of time.

TABLE 8-1. SAR RELATED SUPPORT DATA EXTENSIONS

AIMIDA	Additional Image Identification	
EXPLTA	Exploitation Related Information	
BLOCKA	Image Block Information	
SECTGA	Secondary Targeting Information	
MPDSRA	Mensuration Data	
MENSRA	Airborne SAR Mensuration Data	
ACFTA	Aircraft Information	
PATCHA	Patch Information	
MTIRPA	Moving Target Information Report	

8.2 TECHNICAL NOTES ON COORDINATE SYSTEMS

The historic coordinate system for SAR is a left to right, bottom up system. When mapping on the right side of the aircraft, the first pixel of each scan line is at minimum range with subsequent pixels at increasing range; when mapping on the left side, the first pixel of each scan line is at maximum range with subsequent pixels at decreasing range. See figure 8-1.

The NITF coordinate system is a left to right, top to bottom, and coordinate system. Column numbers increase to the right, and row numbers increase downwards. The first pixel within a block is at the upper left, with subsequent pixels to the right along the row, until the last pixel of a row is followed by the left-most pixel of the next lower row. See figure 8-2. Note: The SAR image depiction in figure 8-2 is oriented 180° from figure 1, with the oldest line at the top (i.e., the sensor is flying toward the bottom of the figure).

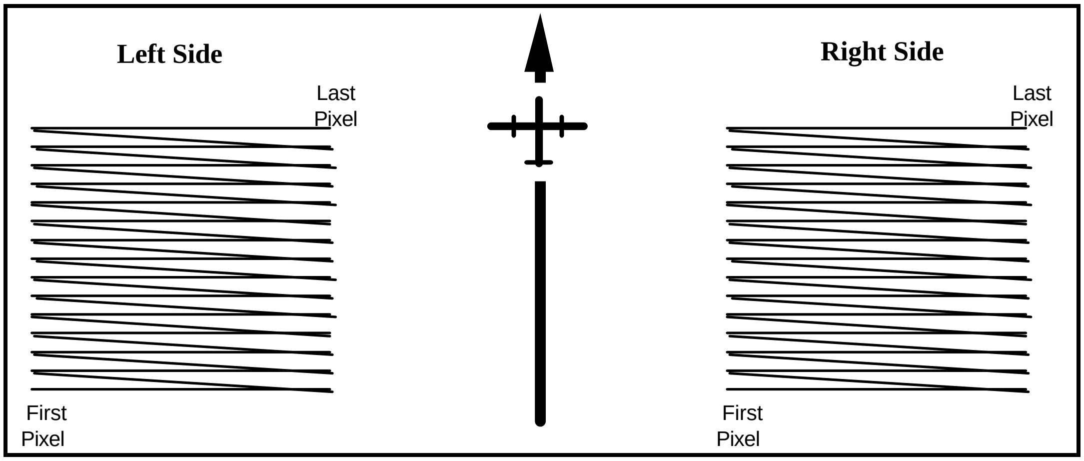

FIGURE 8-1. SAR SCANNING PATTERNS

The order of pixels within each image row must be reversed before a SAR image is imbedded within a NITF file in order to prevent a mirrored view of the scene from being displayed on NITF screens.

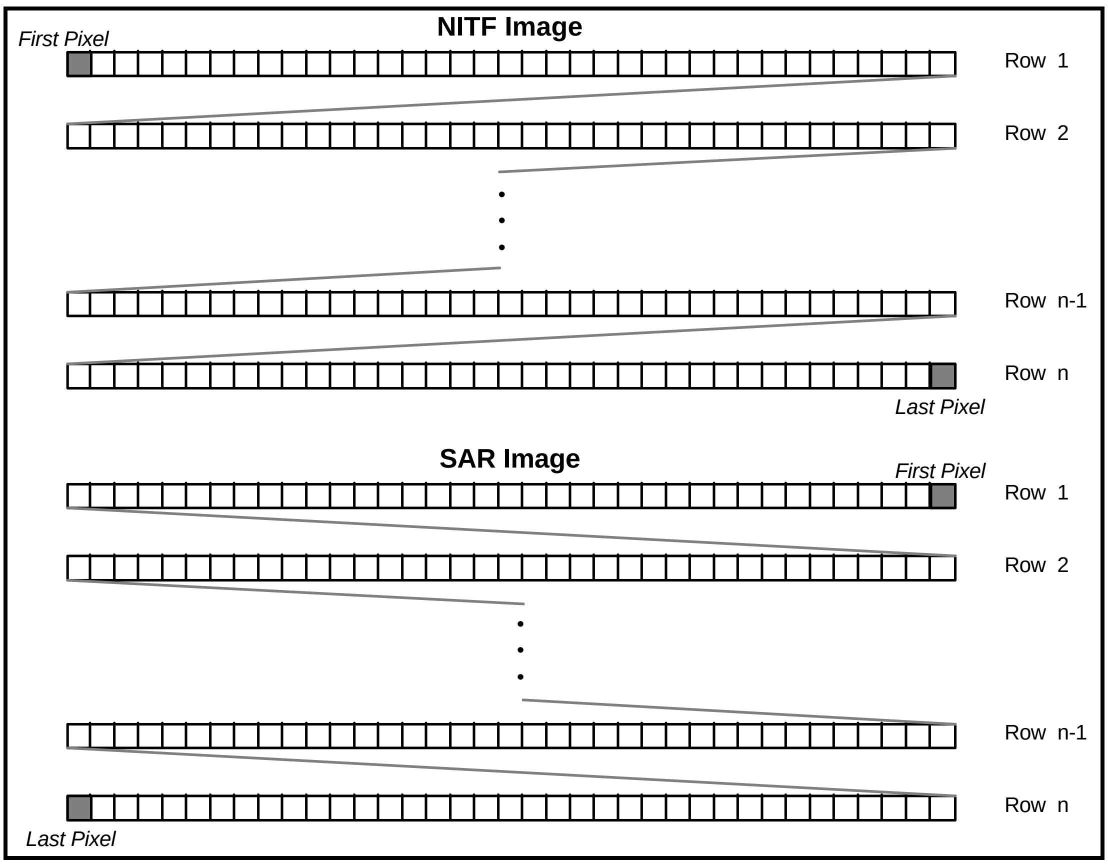

FIGURE 8-2. SAR AND NITF COORDINATE SYSTEMS

8.3 DETAILED REQUIREMENTS

The TRE defined in this section are "controlled TREs" as defined in Section 5.9 of the NITF 2.0 standard. The TRE format is summarized here for ease of reference. Tables 8-2 and 8-3 describe the general format of a CE.

TABLE 8-2. CONTROLLED TAGGED RECORD EXTENSION FORMAT
R = Required, O = Optional, and C = Conditional

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Type Identifier	6	alphanumeric	N/A	R
CEL	Length of CEDATA Field	5	00001 to 99988	bytes	R
CEDATA	User-Defined Data	†	User-defined	N/A	R

† equal to value of CEL field

TABLE 8-3. CONTROLLED TAGGED RECORD EXTENSIONS FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain a valid alphanumeric identifier properly registered with the NITF Technical Board.
CEL	This field shall contain the length in bytes of the data contained in CEDATA. The tagged record's length is 11+ the value of CEL.
CEDATA	This field shall contain data primarily of character data type (binary data is acceptable for extensive data arrays, such as color palettes or look-up tables) defined by and formatted according to user specification. The length of this field shall not cause any other NITF field length limits to be exceeded but is otherwise fully user defined.

The CETAG and CEL fields essentially form a small (11-byte) tagged record subheader. The format and meaning of the data within the CEDATA field is the subject of this section for several, individual controlled TREs.

Multiple tagged extensions can exist within the TRE area. There are several such areas, each of which can contain 99,999 bytes worth of tagged extensions. There is also an overflow mechanism, should the sum of all tags in an area exceed 99,999 bytes. The overflow mechanism allows for up to 1 Gbyte of tags.

While the extensions defined in this section will typically be found in the image subheader, it is possible that they could appear in a DES, which is being used as an overflow of the image subheader.

If the information contained within an extension is not available, the extension will not be present in the file. For example, if no moving target information is available, no MTIRPA extensions will be present. The set of extensions stored within the file can change over the lifetime of the image, due to additional information or removal of outdated information. For example, moving target information may be of fleeting value, while the image depicting them may be archived for future reference; the MTIRPA extensions can be removed before archiving without damaging the remaining information. When an extension is present, all of the information listed as required must be filled in with valid information. Information listed as Optional (type = O) may contain valid information, or may contain ASCII spaces to indicate that valid data is unavailable. Reserved fields support applications beyond the scope of this section, and normally contain spaces where no value is explicitly specified; however, other values are possible.

8.3.1 AIMIDA - ADDITIONAL IMAGE ID

The additional image ID tag is intended to be the most basic support data extension for SAR imagery, and is a prerequisite for all other tags defined in this section. The format for the user-defined fields of the AIMIDA extension is detailed in table 8-4, and the descriptions of these fields is detailed in table 8-5. A single AIMIDA is placed in the image subheader. Where several image subheaders relate to a single scene, AIMIDA is placed in the first image subheader.

TABLE 8-4. AIMIDA – ADDITIONAL IMAGE ID EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	AIMIDA	N/A	R
CEL	Length of Entire Tagged Record	5	00069	bytes	R
The following fields define AIMIDA					
MISSION_DATE	Aircraft T.O. Date	7	DDMonYY		R
MISSION_NO	Mission ID	4	0000 to 9999		R
FLIGHT_NO	Flight Number.	2	01 to 09, A1 to A9 B1 to B9 … Z1 to Z9		R
OP_NUM	Image Operation Number.	3	001 to 999		R
	reserved	2	spaces		R
REPRO_NUM	Reprocess Number.	2	00 to 99		R
REPLAY	Retransmission Number.	3	000, T01 to T99, G01 to G99, P01 to P99		R
	reserved	1	space		R
START_COLUMN	Block Number.	2	01 to 27		R
START_ROW	"	5	00001 to 99999		R
	reserved	2	spaces		R
END_COLUMN	Block Number.	2	01 to 27		R
END_ROW	"	5	00001 to 99999		R
COUNTRY	Country Code	2	AA to ZZ		O
	reserved	4	spaces		R
LOCATION	Latitude and Longitude	11	ddmmXdddmmY		R
TIME	Time of First Line	5	hhmmZ		R
CREATE_DATE	Date of First Line	7	DDMonYY		R

TABLE 8-5. AIMIDA – ADDITIONAL IMAGE ID FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS__
MISSION_DATE	This field shall contain the date of the collection mission (date of aircraft takeoff) in the format DDMonYY, in which DD is the day of the month (00 to 31), Mon is the first three characters of the month (JAN to DEC), and YY is the last two digits of the year (00 to 99).
MISSION_NO	Four digit descriptor of the mission.
FLIGHT_NO	A flight number in the range 01 to 06 shall identify each flight. Flight 01 shall be the first flight of the day, flight 02 the second, etc. In order to ensure uniqueness in the image id, if the aircraft mission extends across midnight GMT, the flight number shall be 0x (where x is in the range 0 to 6) on images acquired before midnight GMT and Ax on images acquired after midnight GMT; for extended missions Bx, … Zx shall designate images acquired on subsequent days.
OP_NUM	Imaging operation number. Reset to 1 at the start of each flight.
REPRO_NUM	Reprocess Number indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A "00" in this field indicates that the data is an originally processed image, a range of "01" to "99" indicates the data is reprocessed.
REPLAY	Replay indicates whether the data was retransmitted to overcome reception errors. A "00" in this field indicates that the data is from an original transmission, a value in the range of "T01" to "T99" indicates the data was retransmitted. Values in the range of "G01" to "G99" and "P01" to "P99" are reserved for possible future implementation.
START_COLUMN	Starting column Block Number. (cross scan direction).
START_ROW	Starting row Block Number. (along scan direction).
END_COLUMN	Ending column Block Number. (cross scan direction).
END_ROW	Ending row Block Number. (along scan direction).
COUNTRY	Two-letter code defining the country for the reference point of the image segment.
LOCATION	Location of the center of the first image block, provides rough indication of geographic coverage. The format ddmmX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X = N or S for north or south, and dddmmY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y = E or W for east or west, respectively.
TIME	This field shall contain the collection time referenced to GMT, and accurate to 1 minute, of the first line of the image in the format hhmmZ, in which hh is the hour (00 to 23), and mm is the minute (00 to 59); the final character "Z" is required.
CREATE_DATE	This field shall contain the collection date of the first line of the image in the format DDMonYY, in which DD is the day of the month (00 to 31), Mon is the first three characters of the month (JAN to DEC), and YY is the last two digits of the year (00 to 99). This date is coordinated with the collection time, i.e., the date changes at midnight GMT.

8.3.2 EXPLTA - EXPLOITATION RELATED INFORMATION

The format for the user defined fields of the EXPLTA extension is detailed in table 8-6, and the descriptions of these fields is detailed in table 8-7. A single EXPLTA is placed in the image subheader, following AIMIDA.

TABLE 8-6. EXPLTA – EXPLOITATION RELATED INFORMATION EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	EXPLTA	N/A	R
CEL	Length of Entire Tagged Record	5	00087	bytes	R
The following fields define EXPLTA					
ANGLE_TO_NORTH	Angle to True North	3	000 to 359	degrees	R
SQUINT_ANGLE	Squint Angle	3	±60	degrees	R
MODE	Imaging Mode	3	xSP,xGP,xES,yyS		R
	reserved	16	spaces		R
GRAZE_ANG	Focus plane grazing angle	2	00 to 90	degrees	R
SLOPE_ANG	Focus plane slope angle	2	00 to 90	degrees	R
POLAR	Polarization	2	HH, HV, VH, VV		R
NSAMP	Pixels per Line	5	00001 to 99999		R
	reserved	1	0		R
SEQ_NUM	Sequence within Coupled Imagery Set	1	1 to 6		O
PRIME_ID	ID of Primary Target	12	alphanumeric		O
PRIME_BE	BE of Primary Target	15	alphanumeric		O
	reserved	1	0		R
N_SEC	Number of Secondary Targets†	2	00 to 10		O
IPR	Commanded IPR††	2	00 to 99	feet	O
	reserved	2	01		R
	reserved	2	spaces		R
	reserved	5	00000		R
	reserved	8	spaces		R

† determines number of SECTGA extensions
†† replicated in each MPDSRA extension

TABLE 8-7. EXPLTA – EXPLOITATION RELATED INFORMATION FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ANGLE_TO_NORTH	Angle measured clockwise in degrees from first row of the image to True North.
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from 0 (broadside) to +60 degrees; aft looking squint angles range from 0 to -60 degrees.
MODE	Mode represents both the collection mode and the processing mode. For Spot imagery the first character indicates the collection mode with "1" for either SPOT 1 Mode, and "3" for SPOT 3 Mode; the second and third characters indicate the processing (sampling) mode: "SP"=Slant Plane, "GP"=Ground Plane, and "ES"=Enhanced Spot. For Search mode imagery the first two characters yy represent the nominal impulse response, and the third character is "S."
GRAZE_ANG	The angle measured in degrees at the target, between the focus plane and line of sight to the radar.
SLOPE_ANG	Given GRAZE_ANG y and SQUINT_ANGLE q, $SLOPE\_ANG = \cos^{-1}\left[\frac{\cos y \ \cos q}{\sqrt{(\sin^2 y \ \sin^2 q + \cos^2 q)}}\right]$ Note: SLOPE_ANG is equal to GRAZE_ANG for broadside mapping (q = 0).
POLAR	The first character indicates the nominal transmit polarization, and the second character indicates the nominal receive polarization. Each can be Horizontal (H) or Vertical (V).
NSAMP	Pixels per Line (includes fill)
SEQ_NUM	Sequence within Coupled Imagery Set
PRIME_ID	Target Designator of primary target
PRIME_BE	Basic Encyclopedia ID of the primary target
N_SEC	Number of secondary targets in image
IPR	Commanded impulse response.

8.3.3 BLOCKA - IMAGE BLOCK INFORMATION.

The format for the user-defined fields of the BLOCKA extension is detailed in table 8-8, and the descriptions of these fields is detailed in table 8-9. BLOCKA is placed in the image subheader. Where several image subheaders relate to a single scene BLOCKA is placed in the first image subheader.

TABLE 8-8. BLOCKA – IMAGE BLOCK INFORMATION EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	BLOCKA	N/A	R
CEL	Length of Entire Tagged Record	5	00123	bytes	R
The following fields define BLOCKA					
BLOCK_INSTANCE	Block number	2	01 to 99		R
N_GRAY	Number of gray fill samples	5	00000 to 99999		R
L_LINES	Line Count	5	00001 to 99999		R
LAYOVER_ANGLE	Radar Layover Angle	3	000 to 359	degrees	O
SHADOW_ANGLE	Radar Shadow Angle	3	000 to 359	degrees	O
	reserved	16	spaces		O
FRLC_LOC	First Row Last Column Location	21	Xddmmss.ssYdddmmss.ss		R
LRLC_LOC	Last Row Last Column Location	21	Xddmmss.ssYdddmmss.ss		R
LRFC_LOC	Last Row First Column Location	21	Xddmmss.ssYdddmmss.ss		R
FRFC_LOC	First Row First Column Location	21	Xddmmss.ssYdddmmss.ss		R
	reserved	5	010.0		R

TABLE 8-9. BLOCKA – IMAGE BLOCK INFORMATION FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
BLOCK_INSTANCE	Block number of this image block,
N_GRAY	Number of gray Fill samples
L_LINES	Line Count
LAYOVER_ANGLE	The angle between the first row of pixels and the layover direction in the image; positive values indicate a clockwise direction.
SHADOW_ANGLE	The angle between the first row of pixels and the radar shadow in the image; positive values indicate a clockwise direction.
FRLC_LOC LRLC_LOC LRFC_LOC FRFC_LOC	Latitude and longitude at the first row last column of the image block. Latitude and longitude at the last row last column of the image block. Latitude and longitude at the last row, first column of the image blocks. Latitude and longitude at the first row, first column of the image blocks. The format Xddmmss.ss represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and Ydddmmss.ss represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. These locations, at lower precision, are also contained in IGEOLO of the image subheader.

8.3.4 SECTGA - SECONDARY TARGETING INFORMATION

The format for the user-defined fields of the SECTGA extension is detailed in table 8-10, and the descriptions of these fields is detailed in table 8-11. As many as ten SECTGA extensions can exist in a single NITF file, with the N_SEC field of EXPLTA providing the total count. Either SEC_ID, SEC_BE, or both must contain a valid identifier.

TABLE 8-10. SECTGA – SECONDARY TARGETING INFORMATION EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	SECTGA	N/A	R
CEL	Length of Entire Tagged Record	5	00028	bytes	R
The following fields define SECTGA					
SEC_ID	ID of Secondary Target	12	alphanumeric		O
SEC_BE	BE of Secondary Target	15	alphanumeric		O
	reserved	1	0		R

TABLE 8-11. SECTGA – SECONDARY TARGETING INFORMATION EXTENSION FORMAT

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
SEC_ID	Designator of secondary target
SEC_BE	Basic Encyclopedia ID of secondary target

8.3.5 MPDSRA - MENSURATION DATA

The format for the user-defined fields of the MPDSRA extension is detailed in table 8-12, and the descriptions of these fields is detailed in table 8-13.

TABLE 8-12. MPDSRA – MENSURATION DATA EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MPDSRA	N/A	R
CEL	Length of Entire Tagged Record	5	00188	bytes	R
The following fields define MPDSRA					
BLK_NUM	Image Block Number	2	01 to 99		R
IPR	Commanded IPR	2	01 to 99	feet	R
NBLKS_IN_WDG	Number of Image Blocks in WDG	2	01 to 99		R
ROWS_IN_BLK	Number of Rows in Image Block	5	00001 to 99999		R
COLS_IN_BLK	Number of Columns in Image Block	5	00001 to 99999		R
ORP_X	Output Reference Point (ECF)	9	±99999999	feet	O
ORP_Y	"	9	±99999999	feet	O
ORP_Z	"	9	±99999999	feet	O
ORP_ROW	Row Containing ORP	5	00001 to 13600		O
ORP_COLUMN	Column Containing ORP	5	00001 to 16384		O
FOC_X	Focus Plane Normal Vector	7	±1.0000		O
FOC_Y	"	7	±1.0000		O
FOC_Z	"	7	±1.0000		O
ARP_TIME	Collection Start Time (GMT)	9	00000.000 to 86399.999	seconds	R
	reserved	14	spaces		R
ARP_POS_N	Aircraft Location,	9	±99999999	feet	R
ARP_POS_E	"	9	±99999999	feet	R
ARP_POS_D	"	9	±99999999	feet	R
ARP_VEL_N	Aircraft Velocity	9	±99999.99	feet/sec	R
ARP_VEL_E	"	9	±99999.99	feet/sec	R
ARP_VEL_D	"	9	±99999.99	feet/sec	R
ARP_ACC_N	Aircraft Acceleration	8	±100.000	feet/sec^2	R
ARP_ACC_E	"	8	±100.000	feet/sec^2	R
ARP_ACC_D	"	8	±100.000	feet/sec^2	R
	reserved	13	000.0000001.0		R

TABLE 8-13. MPDSRA – MENSURATION DATA FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
BLK_NUM	Image block number in which the Output Reference Point occurs.
IPR	Commanded IPR
NBLKS_IN_WDG	Total number of image blocks in the file.
ROWS_IN_BLK	Number of rows in image block
COLS_IN_BLK	Number of columns in image block
ORP_X ORP_Y ORP_Z	X, Y, and Z components of Output Reference Point (ORP) position vector in Earth Centered Fixed (ECF) coordinate system.
ORP_ROW	Row containing ORP
ORP_COL	Column containing ORP
FOC_X FOC_Y FOC_Z	X, Y, and Z components of Focal Plane Normal (FPN) Vector in Earth Centered Fixed (ECF) coordinate system.
ARP_TIME	Collection Start Time in seconds past midnight GMT
ARP_POS_N ARP_POS_E ARP_POS_D	The Aircraft Reference Point position at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.
ARP_VEL_N ARP_VEL_E ARP_VEL_D	The Aircraft Reference Point velocity at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.
ARP_ACC_N ARP_ACC_E ARP_ACC_D	The Aircraft Reference Point acceleration at ARP_TIME is given in a North, East, Down, earth fixed coordinate system with the origin at the scene entry point for the Search mode and at the CCRP for the SPOT modes.

8.3.6 MENSRA - AIRBORNE SAR MENSURATION DATA

The format for the user defined fields of the MENSRA extension is detailed in table 8-14, and the descriptions of these fields are detailed in table 8-15.

TABLE 8-14. MENSRA – AIRBORNE SAR MENSURATION DATA EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MENSRA	N/A	R
CEL	Length of Entire Tagged Record	5	00155	bytes	R
The following fields define MENSRA					
Collection Central Reference Point (CCRP):					
CCRP_LOC	CCRP Location	21	ddmmss.ssXdddmmss.ssY		R
CCRP_ALT	CCRP Altitude	6	-01000 to +30000	feet	R
OF_PC_R	Offset Between CCRP And Patch Center, Range	7	±2000.0	feet	R
OF_PC_A	Offset Between CCRP And Patch Center, Azimuth	7	±2000.0	feet	R
COSGRZ	Cosine of Grazing Angle	7	0.00000 to 1.00000		R
RGCCRP	Range to CCRP	7	0000000 to 3000000	feet	R
RLMAP	Right/Left	1	L or R		R
CCRP_ROW	CCRP row number	5	00000 to 13600		R
CCRP_COL	CCRP column number	5	00000 to 16384		R
Aircraft Position:					
ACFT_LOC	Aircraft Location	21	ddmmss.ssXdddmmss.ssY		R
ACFT_ALT	Aircraft Altitude	5	00000 to 99999	feet	R
CCRP Unit Basis Vector:					
C_R_NC	Range Unit Vector, North	7	±1.0000		R
C_R_EC	Range Unit Vector, East	7	±1.0000		R
C_R_DC	Range Unit Vector, Down	7	±1.0000		R
C_AZ_NC	Azimuth Unit Vector, North	7	±1.0000		R
C_AZ_EC	Azimuth Unit Vector, East	7	±1.0000		R
C_AZ_DC	Azimuth Unit Vector, Down	7	±1.0000		R
C_AL_NC	Altitude: North Component	7	±1.0000		R
C_AL_EC	Altitude: East Component	7	±1.0000		R
C_AL_DC	Altitude: Down Component	7	±1.0000		R

TABLE 8-15. MENSRA – AIRBORNE SAR MENSURATION DATA FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
Collection Central Reference Point (CCRP):	
CCRP_LOC CCRP_ALT	In the Search mode, the airborne system chooses a Collection Central Reference Point (CCRP) along the scene centerline for each patch. The CCRP will be near the patch line center. In the Spot Mode, the CCRP is in the exact center of the scene. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The CCRP altitude is the altitude in feet of the CCRP above mean sea level (MSL).
OF_PC_R OF_PC_A	In the Search mode the airborne system chooses a Collection Central Reference Point (CCRP) along the scene centerline for each patch. The patch center (PC), the actual, geometric center of the processed imagery, is offset from the CCRP along the scene centerline. The range and azimuth offsets are given in feet. Increasing range is positive. Azimuth in the direction, which subtends an acute angle with the directed scene track, is positive. In the Spotlight mode, the patch center is the CCRP; therefore, the offsets are both equals to 0.
COSGRZ	Cosine of the Graze Angle is computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). cos (y) = RGM/RSM
RGCCRP	Estimated slant range in feet from the antenna at mid collection array to the CCRP.
RLMAP	This field indicates whether the map was imaged from the right (R) side or the left (L) side of the aircraft.
CCRP_ROW	Number of row containing the CCRP
CCRP_COL	Column containing the CCRP
Aircraft Position:	
ACFT_LOC	The aircraft position at the GMT of the Patch. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.
ACFT_ALT	The aircraft altitude in feet above mean sea level (MSL) at the GMT of the Patch.
CCRP Unit Basis Vector:	
C_AZ_NC C_AZ_EC C_AZ_DC C_AL_NC C_AL_EC C_AL_DC	The computations of patch parameters are based on a rectangular coordinate system at the current patch CCRP. The unit basis vectors for this local coordinate system are the range, azimuth and altitude vectors. The range vector points in the range direction away from the aircraft; the azimuth vector points in the cross range direction, and subtends an acute angle with the directed scene track; and the altitude vector points straight up. The variables are given as real numbers and are referred to a North, East, Down coordinate system whose origin is at the scene entry point. These data have meaning in Search scenes only.

8.3.7 ACFTA - AIRCRAFT INFORMATION

The format for the user defined fields of the ACFTA extension is detailed in table 8-16, and the descriptions of these fields is detailed in table 8-17.

TABLE 8-16. ACFTA – AIRCRAFT INFORMATION EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	ACFTA	N/A	R
CEL	Length of Entire Tagged Record	5	00132	bytes	R
The following fields define ACFTA					
AC_MSN_ID	Aircraft Mission Identification	10	alphanumeric		R
SCTYPE	Scene Type	1	C,R,space C = Collection Plan R = Retasked space = Immediate, or Unplanned		R
SCNUM	Scene Number	4	0000 to 9999		R
SENID	Sensor ID	3	alphanumeric		R
PATCH_TOT	Total Number. of Patches	4	Spot: 0001 Search: 0001 to 0999		R
MTI_TOT	Total Number of MTI Packets	3	000 to 120		R
PDATE	Processing Date	7	DDMonYY		R
IMHOSTNO	Immediate Scene Host	3	000 to 511		O
IMREQID	Immediate Scene Request ID	5	00000 to 32767		O
SCENE_SOURCE	Scene Source	1	0 to 6		O
MPLAN	Mission Plan Mode	2	01 to 13		R
ENTLOC	Entry Location	21	ddmmss.ssXdddmmss.ssY		R
ENTALT	Entry Altitude	6	-01000 to +30000	feet	R
EXITLOC	Exit Location	21	ddmmss.ssXdddmmss.ssY		O
EXITALT	Exit Altitude	6	-01000 to +30000	feet	O
TMAP	True Map Angle	7	000.000 to 180.000	degrees	R
RCS	RCS Calibration Coefficient	3	040 to 080		O
ROW_SPACING	Row Spacing	7	00.0000 to 99.9999	feet	R
COL_SPACING	Column Spacing	7	00.0000 to 99.9999	feet	R
SENSERIAL	Sensor Serial Number.	4	0001 to 9999		O
ABSWVER	Airborne SW Version	7	vvvv.rr		O

TABLE 8-17. ACFTA – AIRCRAFT INFORMATION FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
AC_MSN_ID	Name of the Mission.
SCTYPE SCNUM	Scene Type & Number identifies the current scene, and is determined from the mission plan, except for immediate spot scenes, where it has the value 0. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.
SENID	Sensor ID
PATCH_TOT	Total Number of Patches contained in this file, and therefore the number of PATCHA extensions.
MTI_TOT	Total Number of MTIRPA extensions contained in this file. Each MTIRPA identifies 1 to 256 moving targets.
PDATE	The Processing Date is the day, month and year that the raw data is converted to imagery.
IMHOSTNO IMREQID	Only valid for immediate scenes. Together they will denote the scene that the immediate was initiated from and can be used to renumber the scene, Example: If the immediate scene was initiated from scene number 123 and this is the third request from that scene, then the scene number field will be zero, the immediate scene host field will contain 123 and the immediate scene request id will contain 3. The scene can then be re-designated as scene 123.3 or converting three to an alpha character the scene can be referred to as 123C.
SCENE_SOURCE	The Scene Source indicates the origin of the request for the current scene. 0 = Preplanned 1 = Scene Update (uplink) 2 = Scene Update (Manual) (Via pilot's cockpit display unit) 3 = Immediate Scene (Immediate Spot or Search Range Adjust) 4 = Spare 5 = Preplanned Tape Modification 6 = SSS
MPLAN	The Mission Plan Mode describes the current collection mode. 1 = Search 2 = Spot 3 4 = Spot 1 7 = Continuous Spot 3 8 = Continuous Spot 1 9 = EMTI Wide Frame Search 10 = EMTI Narrow Frame Search 11 = EMTI Augmented Spot 12 = EMTI Wide Area MTI (WAMTI) 13 = Monopulse Calibration

TABLE 8-17. ACFTA – AIRCRAFT INFORMATION FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ENTLOC ENTALT EXITLOC EXITALT	In the Search mode, the entry and exit locations are the specified latitude; longitude and altitude above mean sea level (MSL) of the planned entry and exit points on the scene centerline. In the Spot mode, the entry location is the specified Spot center latitude/longitude/altitude, and the exit location is not used. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The altitude is expressed in feet.
TMAP	In Search modes, the true map angle is the angle between the scene centerline to the ground projection of the antenna look vector expressed in degrees. In Spot modes, the true map angle is the angle between a line through the CCRP parallel to the aircraft desired track heading to the ground projection of the vector from the aircraft to CCRP. This angle is always positive.
RCS	Performance calibration value for sensor equipment.
ROW_SPACING	Ground plane distance between corresponding pixels of adjacent rows.
COL_SPACING	Ground plane distance between adjacent pixels within a row.
SENSERIAL	Sensor (Receiver/Exciter) Serial Number
ABSWVER	Version (vvvv) and revision (rr) numbers for the airborne software.

8.3.8 PATCHA - PATCH INFORMATION

The format for the user-defined fields of the PATCHA extension is detailed in table 8-18, and the descriptions of these fields is detailed in table 8-19. A search scene typically consists of many abutting patches; each patch of the scene may be treated as an independent image and placed into a separate file, or the multiple patches (up to 999) of a scene may all be placed into a single file. There will always be 1 patch per file in spot mode. PATCHA occurs once for each patch, and is placed in the image subheader containing the described patch.

TABLE 8-18. PATCHA – PATCH INFORMATION EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	PATCHA	N/A	R
CEL	Length of Entire Tagged Record	5	00115	bytes	R
The following fields define PATCHA					
PAT_NO	Patch Number	4	0001 to 0999		R
LAST_PAT_FLAG	Last Patch of Search Scene	1	0,1		O
LNSTRT	Start line number for this patch	7	0000001 to 9999999		R
LNSTOP	End line number for this patch	7	0000200 to 9999999		R
AZL	Number of Azimuth Lines	5	00200 to 99999	lines	R
NVL	Number of valid azimuth lines	5	00200 to 99999	lines	O
FVL	First Valid Line	3	001 to 681		O
NPIXEL	Number of image pixels per line	5	Spot: 00170 to 02720 Search: 00272 to 08160	pixels	R
FVPIX	First Valid Pixel	5	Spot: 00001 to 02551 Search: 00001 to 07889		R
FRAME	Spot Frame Number	3	001 to 512		O
GMT	Greenwich Mean Time	8	00000.00 to 86399.99	seconds	R
SHEAD	Scene Heading	7	000.000 to 359.999	degrees	R
GRAVITY	Local Gravity	7	31.0000 to 33.9999	$feet/sec^2$	R
INS_V_NC	Ins Platform Velocity, North	5	00000 to 99999	feet/sec	R
INS_V_EC	Ins Platform Velocity, East	5	00000 to 99999	feet/sec	R
INS_V_DC	Ins Platform Velocity, Down	5	00000 to 99999	feet/sec	R
OFFLAT	Geodetic Latitude Offset	8	±80.0000	seconds	R
OFFLONG	Geodetic Longitude Offset	8	±80.0000	seconds	R
TRACK	Track Heading	3	000 to 359	degrees	R
GSWEEP	Ground Sweep Angle	6	000.00 to 120.00	degrees	R
SHEAR	Patch Shear Factor	8	0.850000 to 1.000000		R

TABLE 8-19. PATCHA – PATCH INFORMATION FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PAT_NO	Patch Number. Patches are numbered consecutively for a scene within a file, starting with patch 1.
LAST_PAT_FLAG	Flag to indicate that this patch is the last in a search scene. When all patches of a scene are not contained within a single file, PATCH_TOT in ACFTA cannot indicate the total number of patches in the scene; this flag then makes it clear that the scene ends with this patch. 0 = Not End, 1 = End.
LNSTRT LNSTOP	Absolute starting and ending line numbers of this patch within an overall image (scene). Provides similar information to ILOC in the image subheader, but in a form more suitable for some operations. Identifies specifically where this patch fits relative to the other N patches comprising an overall scene, whereas relative values in ILOC are referenced to the object to which this patch is attached.
AZL	This variable indicates how many lines are in the current patch. In Search Mode, each patch consists of from 200 to 1600 azimuth lines. Because the number of lines is a constant in the Spot mode, this variable is set to 2,720.
NVL FVL	The Spot mode frame dimensions are 2,720 azimuth lines by 2,720 range pixels. In the Continuous Spot mode, the Spot scene does not always completely fill the frame. Therefore, these variables together describe the location of the valid imagery within the 2,720 azimuth lines transferred. These variables have no meaning in the Search mode.
NPIXEL	Number of image pixels per line
FVPIX	The First Valid Pixel Index defines the location of the first pixel on a line. This variable, with the number of pixels per line, will define the location of the image within the 8,160 pixels per line for search and 2,720 for spot.
FRAME	In Continuous Spot Mode, each image about the same Map Center (a single scene) is called a Frame. The Frame Number starts at 1 and is incremented by 1 for each frame of the scene. Contains spaces for Search and Single Spot modes.
GMT	The Greenwich Mean Time (GMT) is the time in seconds (accurate to 0.01 seconds) of the start of the current patch or, in the case of Spot, the current scene or frame. GMT uses a 24-hour clock where a value of 0 corresponds to 2400 hours.
SHEAD	The Scene Heading is a variable that references the scene to True North. In Search scenes, it is the angle from True North to the Scene CenterLine. In Spotlight Scenes, it is the angle from True North to the Azimuth Vector.
GRAVITY	The local gravity is the acceleration due to gravity. The units are in feet/sec^2.
INS_V_N INS_V_E INS_V_D	The Inertial Navigator Platform velocity is given in a North, East, Down earth-fixed coordinate system. The measurements are given in units of feet/second. These parameters are valid at the time specified by GMT.
OFFLAT OFFLONG	The Geodetic Latitude/Longitude Offset is the accumulated latitude/longitude correction currently being used to correct the Inertial Navigation System (INS) aircraft position outputs. The offset is given in seconds of a degree; North/East is positive.

TABLE 8-19. PATCHA – PATCH INFORMATION FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
TRACK	The track heading is measured in degrees relative to true North. The measurement is clockwise about the vertical from North to the projection of the aircraft roll axis into the level plane, and is valid at the time specified by GMT.
GSWEEP	The ground sweep angle is determined by the required azimuth resolution and is the angle over which phase history is collected. The measurements are given in degrees.
SHEAR	Targets are imaged in the slant plane determined by the Processing Central Reference Point and the SAR velocity vector at mid-array. The conversion from target spacing in the ground plane to target spacing in the slant plane for each patch allows the optimal matching of terrain features in one patch to those in the next.

8.3.9 MTIRPA - MOVING TARGET REPORT

The format for the user defined fields of the MITRPA extension is detailed in table 8-20, and the descriptions of these fields is detailed in table 8-21.

TABLE 8-20. MTIRPA – MOVING TARGET REPORT EXTENSION FORMAT

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier	6	MTIRPA	N/A	R
CEL	Length of Entire Tagged Record	5	00072 to 08742	bytes	R
The following fields define MTIRPA					
MTI_DP	Destination Point	2	01 to 99		O
MTI_PACKET_ID	MTI Packet ID Number	3	001 to 120		R
PATCH_NO	Patch Number	4	0001 to 0999		R
WAMTI_FRAME_NO	WAMTI Frame Number	5	00001 to 32767		O
WAMTI_BAR_NO	WAMTI Bar Number	1	1 to 7		O
GMT	Greenwich Mean Time	8	00000.00 to 86399.99	seconds	R
SQUINT_ANGLE	Squint Angle	5	±60.0	degrees	O
COSGRZ	Cosine of Grazing Angle	7	0.00000 to 1.00000		R
NO_VALID_TGTS	Number of Valid Targets	3	001 to 256		R
TGT_1_LOC	Target Location	21	ddmmss.ssXdddmmss.ssY		R
TGT_1_VEL_R	Target Radial Velocity	4	±200	feet/sec	O
TGT_1_SPEED	Target Estimated Ground Speed	3	000 to 200	feet/sec	O
TGT_1_HEADING	Target Heading	3	000 to 359	degrees	O
TGT_1_AMPLITUDE	Target Signal Amplitude	2	00 to 15		O
TGT_1_CAT	Target Category	1	H,T,U,W		O
…	…	…	…	…	
TGT_256_LOC	Target Offset	21	ddmmss.ssXdddmmss.ssY		C
TGT_256_VEL_R	Target Radial Velocity	4	±200	feet/sec	C
TGT_256_SPEED	Target Estimated Ground Speed	3	000 to 200	feet/sec	C
TGT_256_HEADING	Target Heading	3	000 to 359	degrees	C
TGT_256_AMPLITUDE	Target Signal Amplitude	2	00 to 15		C
TGT_256_CAT	Target Category	1	H,T,U,W		C

TABLE 8-21. MTIRPA – MOVING TARGET REPORT FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MTI_DP	Destination Point at which the scene was collected.
MTI_PACKET_ID	MTI Packet ID Number
PATCH_NO	The number of the patch within which the targets of this report were located.
WAMTI_FRAME_NO	The number of the Frame within which the targets of this report were located. This field is only used with the Wide Area MTI mode.
WAMT1_BAR_NO	The number of the Wide Area Bar within which the targets of this report were located. This field is only used with the Wide Area MTI mode.
GMT	Time in seconds past midnight GMT when the sensor scanned the targets identified in this report.
SQUINT_ANGLE	The angle measured in degrees from crosstrack (broadside) to the great circle joining the ground point directly below the Aircraft Reference Point (ARP) to the Output Reference Point (ORP). Forward looking squint angles range from 0 (broadside) to +60 degrees; aft looking squint angles range from 0 to -60 degrees.
COSGRZ	Cosine of the Graze Angle is computed by dividing the ground plane range of the CCRP to the antenna at mid collection array (RGM) by the slant range of the CCRP to the antenna at mid array (RSM). cos (psi) = RGM/RSM
NO_VALID_TGTS	Number of MTI targets contained in this extension. Determines the number of occurrences of TGT_n_LOC, TGT_n_VEL_R, TGT_n_SPEED, TGT_n_HEADING, TGT_n_AMPLITUDE, and TGT_n_CAT fields.
TGT_n_LOC	Target Location. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west.
TGT_n_VEL_R	Target Radial Velocity in feet per second. A positive value indicates target n is moving away from the sensor, and a negative value indicates target n is moving toward the sensor.
TGT_n_SPEED	Target Estimated Ground Speed in feet per second of the nth moving target.
TGT_n_HEADING	Direction that the nth target is moving rounded to the nearest degree and referenced to True North. 0=North, 90=East, 180=South, and 270=West.
TGT_n_AMPLITUDE	Relative signal strength (0 to 15) of the return for the nth moving target. A value of 0 indicates a target with a very weak return signal while a value of 15 indicates a moving target with a very strong return signal; intermediate values are scaled accordingly. Provides a coarse indication of relative size of the moving target.
TGT_n_CAT	Target classification category of the nth moving target: H = Helicopter T = Tracked U = Unknown W = Wheeled

9.0 IOMAPA TAGGED RECORD EXTENSION DESCRIPTION

The IOMAPA tagged extension contains the data necessary to perform the output amplitude mapping process for each scan within each image frame. This post-processing is applied after the image data has undergone the data expansion process using the 12-bit JPEG/DCT algorithm.

The output amplitude mapping function is generally the inverse of the input amplitude mapping function that is performed as a pre-processing step before the data compression process is executed.

Note: An exception to this case is when the output of the compression is scaled by a factor (S2) to change the precision of the output product relative to the input data precision.

The explanation of the input amplitude mapping is included to describe the pre-processing performed before the compression process. The pre-processing steps are shown in figure 9-1 and the post-processing steps are shown in figure 9-2 for mapping methods 1 through 3.

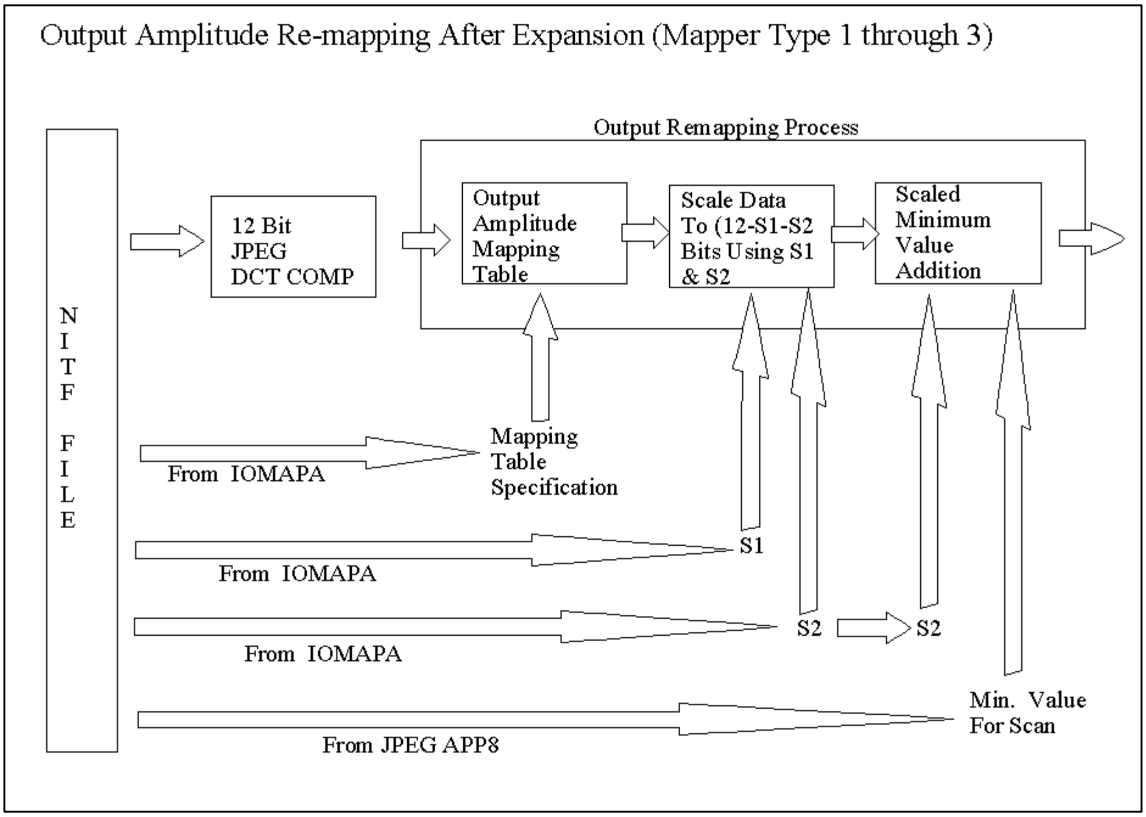

FIGURE 9-1. PRE-PROCESSING STEPS

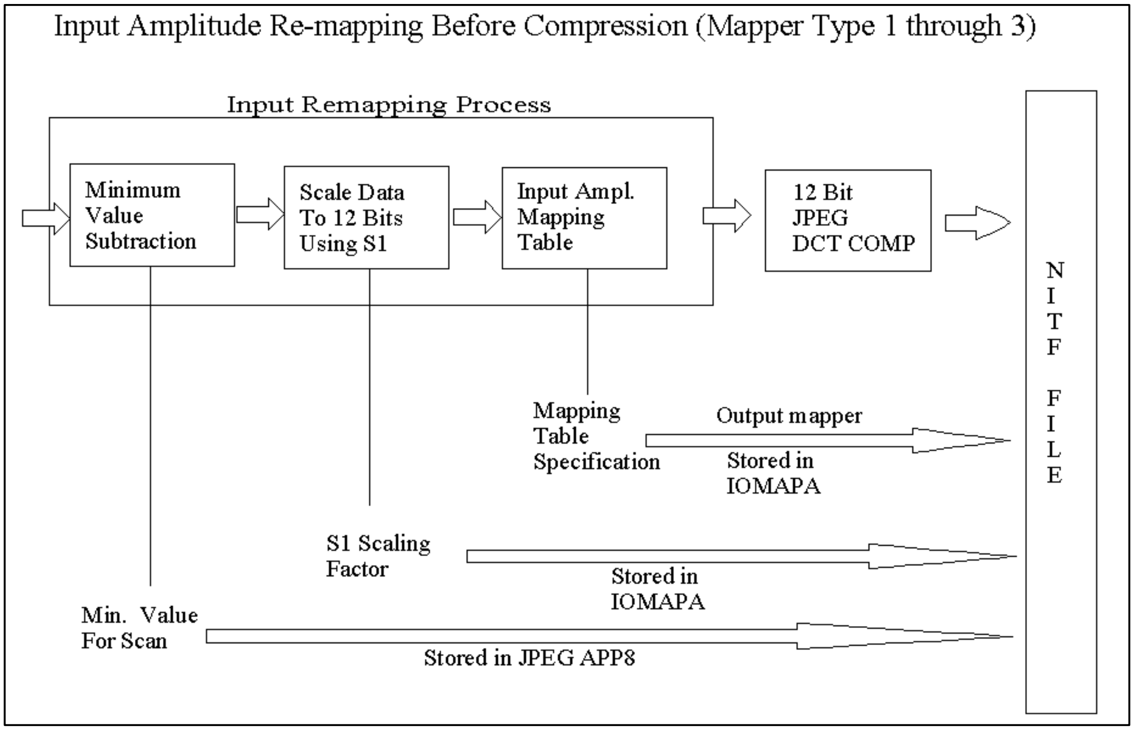

FIGURE 9-2. POST-PROCESSING STEPS

9.1 FORMAT DESCRIPTION AND MAPPING METHOD FUNCTIONS

The IOMAPA data extension is used to transfer the required information needed for the inverse of the input mapping function, i.e., the output amplitude mapping function which is applied to the image data after expansion.

Tables 9-1 to 9-3 defines the format for the NITF controlled tagged record extensions bearing the tag of IOMAPA. The IOMAPA tag is meant to be stored in the image subheader portion of the NITFS file structure. Portions of this tagged record extension are variable depending upon the value of the MAP_SELECT field within the extension.

9.1.1 FUNCTIONALITY OF NITF JPEG/DCT COMPRESSOR USING THE IOMAPA TRE

The input amplitude mapping function takes the image data with a known minimum value and performs a three step pre-processing function on each scan contained in the image frame before it is sent to the JPEG/DCT compressor.

The first operation subtracts the minimum pixel intensity for each scan from each pixel in the corresponding scan of the image frame. For example, the minimum value for scan 1 is subtracted from the pixels contained in the scan 1 data block. The minimum value for each scan is stored in the JPEG application segment, APP6/(Extension NITF0001), in order to pass this information to the expander.

The second step in the mapping process is to use a S1 factor to scale the original data up to a 12-bit precision. If the original input data has 9-bit precision, then the S1 scale factor would be set to 3.

The third step in the mapping process is to apply an input mapping function, specified as part of a compression database, to the data. The compressor fills in the values of the IOMAPA extension from the compression database defining the appropriate output amplitude mapping function to be used by the expander.

In actual practice, the second and third steps can be performed with a scaled lookup table in order to gain efficiency in the implementation of the input mapping process.

If the MAP_SELECT field is equal to 0, then the subtraction of the minimum value from each block shall not be performed. The second and third steps shall also be bypassed because the mapper type 0 is used to turn off the re-mapping process. However, the data can be scaled with the output mapper after the JPEG expansion to decrease the precision of the data if the S2 factor is non-zero.

9.1.1.1 INPUT AMPLITUDE MAPPING METHOD 0

The amplitude mapping method 0 is used to turn off the minimum value subtraction and re-mapping pre-processing options. The minimum values of the scan is loaded into APP6/(Extension NITF0001), and a non-zero S2 output scaling factor can be loaded into the IOMAPA tag, but the data remains unchanged before it is compressed.

9.1.1.2 INPUT AMPLITUDE MAPPING METHOD 1

Table 9-2 describes the format of the controlled tag extension used to pass the parameters used in the amplitude mapping method 1. The controlled tag extension (method 1) contains a value by value listing or table for the output lookup process. The output lookup table is the inverse mapping of the input lookup table used by the compressor.

The input mapping table is contained in a compressor database, but is not needed by the expander and is not included in the IOMAPA tag. The tag also contains the input scale factor value S1, and the output precision scale change value S2.

The input amplitude mapping process that uses the input amplitude-mapping table shall be defined as:

IXX = (IX - MIN) * ISF	Scale the data to 12-bits after the subtraction of the minimum value
If IXX is less than 0 then IXX = 0	Clamp the value to the limits for the input amplitude function
If IXX is greater than IXMAX then IXX = IXMAX	
IXXX = input_amplitude_map_table [IXX]	Input amplitude mapping table with starting index of 0 used to re-map value

Where:

IX	Original Pixel Data
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
ISF = 2**(S1)	Scale Factor Exponent where S1 is a data item included in IOMAPA
IXX	Scaled Original Pixel Data
IMAX = 4096	
IXMAX = IMAX – 1	Maximum Value for Input to Map Table
IXXX	Re-mapped Image Pixel Data
int[]	Denotes integer truncation

Note: The resultant re-mapped value shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to IXMAX.

9.1.1.3 INPUT AMPLITUDE MAPPING METHOD 2

Table 9-3 describes the format of the controlled tag extension used to pass the parameters needed for amplitude mapping method 2. If the MAP_SELECT flag is set to 2, a generalized log mapping shall be utilized as the basis for the input amplitude mapping function. The parameters R, S1, and IMAX shall be used to generate the function. The parameters R, S1, and S2 shall be loaded into the IOMAPA extension. The input amplitude mapping process for when the MAP_SELECT is set to 2 is defined below:

IX = Original Pixel Value

IXX = IX – MIN	Subtract the minimum value for the image block
If R is not equal to 1.0	Perform log mapping
IXXX = int[(B * ln(1.0 + A*IXX)) + 0.5]	
Else	
IXXX = IXX * ISF	Special case for log mapping if R=1.0

Where:

IX	Original Image Pixel Data
IXX	Image Pixel Data after the minimum value subtraction
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
A = (R-1.0)/IXMID	
B = IXMAX/(ln(1.0+A*ISMAX))	
R	Log Ratio data item loaded into IOMAPA
IMAX = 4096	IMAX shall be 4096 for 12-bit JPEG/DCT
IXMAX = IMAX - 1	
ISMAX = (IMAX/ISF)-1	Scaled maximum

IXMID = (IMAX/(2*ISF)	Scaled mid-point
ISF = 2**(S1)	Scale Factor S1
IXXX	Re-mapped Image Pixel Data
int[]	Denotes integer truncation

Note: The resultant re-mapped value IXXX shall then be clamped to ensure that it is greater or equal to zero and less than or equal to IXMAX.

9.1.1.4 INPUT AMPLITUDE MAPPING METHOD 3

Table 9-4 describes the format of the controlled tag extension used to pass the parameters for amplitude mapping method 3. Mapping method 3 uses a 3-segment polynomial mapping process, where each interval is described by a fifth order polynomial. The starting point for each interval and a set of six coefficients defining the polynomial for each segment shall be database items. The coefficients stored in the IOMAPA tag are different from the ones used in the input mapping process.

The coefficients stored in the tag usually reflect the inverse mapping characteristics of the input mapper coefficients. The input mapper coefficients are stored in a compressor database, but are not needed by the expander and are not included in the IOMAPA tag.

If the MAP_SELECT flag is set to the value 3, the following segmented polynomial mapping shall be used for each pixel before the 12-bit JPEG/DCT compression process.

IX = Original Pixel Value

IXX = IX – MIN	Subtract the minimum value for the image block
IXXX = IXX * ISF	Shifted input value IXX is scaled by ISF

The scaled original pixel (IXXX) value shall determine which segment of the polynomial function shall be used.

Segment (J) shall be defined as

XIB(J-1) <= IXXX < XIB(J)	For J = 1, 2, and 3

Where

XIB(J) are segment bounds

XIB(0) = 0 and XIB(3) = 4096

XIB(1) and XIB(2) are contained in a compression database

The scaled input pixel value (IXXX) shall be mapped using the coefficients (ai) for the appropriate polynomial segment as defined above. These coefficients are stored in a compressor database and are not included in the IOMAPA tag. Output coefficients, which perform the inverse operation of the (ai)'s, are included in the IOMAPA tag.

The output mapping segment bounds correspond to the mapped values of the input segment bounds and are included in the NITF CDE IOMAPA. The two output segment boundaries can be calculated using the a0 input mapping coefficients for the second and third segments, respectively. The simple expressions for the output segment boundaries are due to the IZ term being equal to 0 at the XIB(1) and XIB(2) input mapping segment boundaries.

XOB(1) = int[a0 + 0.5]	where a0 is from the input mapping coefficients for segment 2
XOB(2) = int[a0 + 0.5]	where a0 is from the input mapping coefficients for segment 3

The input mapping expression for the polynomial function is given below:

IZ = IXXX - XIB(J-1)

IY = int[a0 + a1*IZ + a2*(IZ**2) + a3*(IZ**3) + a4*(IZ**4) + a5*(IZ**5) + 0.5]

Where:

IX	Original pixel value
IXX	Image Pixel Data after minimum value subtraction
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
IXXX	Scaled value to determine segment number
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
a0, a1, a2, ..., a5	6 Input Mapper Coefficients For Segment J{ X(J-1) <= IXXX < X(J) }
XIB(J-1)	Lower Boundary for Input Mapper Segment J
XOB(J-1)	Lower Boundary for Output Mapper Segment J
IY	Re-mapped image pixel value
IMAX = 4096	
IXMAX = IMAX - 1 = 4095	
int[]	Denotes integer truncation

Note: The output of the polynomial mapping function (IY) shall be clamped to ensure that it is greater than or equal to zero and less or equal to IXMAX.

9.1.2 FUNCTIONALITY OF NITF JPEG/DCT EXPANDER WHEN USING THE IOMAPA TRE

The output amplitude mapping function takes the reconstructed image data from the JPEG expansion process and performs a three step post-processing function on the data unless mapping method 0 is applied. The first step in the re-mapping process is to apply an output mapping function specified by the IOMAPA extension present in the NITF file. The second operation re-scales the data values using the S1 and S2 values. The final operation adds the minimum value extracted from the JPEG APP6/(Extension NITF0001) application segment to each pixel value.

If the MAP_SELECT field is equal to 0, then the re-mapping amplitude function and the addition of the minimum value shall not be performed. Only the S2 factor shall be used to change the precision of the data to (orig_precision-S2) bits.

9.1.2.1 OUTPUT AMPLITUDE MAPPING METHOD 0

The amplitude mapping method 0 code describes to the interpreter of the NITF file that no input or output re-mapping function or minimum value shift is applied to the data. However, if the S2 field is not equal to zero, the data values shall be scaled by the factor of 2**S2. The output scaled pixel value shall use the following expression:

OX = int[(IY/OSF)]

Where:

IY = Pixel Value From JPEG Expander

OSF = 2**(S2)

OX = Output Precision Scaled Pixel Value

9.2.2.2 OUTPUT AMPLITUDE MAPPING METHOD 1

Table 9-2 describes the format of the controlled tag extension for amplitude mapping method 1.

The IOMAPA tag (method 1) contains a value by value listing or table for the output lookup process. The tag also contains the input scale factor value S1, and the output precision scale change value S2.

The output amplitude mapping process, which utilizes the output amplitude-mapping table, shall be defined as:

If IY is less than 0 then IY = 0	Clamp the input to the output amplitude function.
If IY is greater than IXMAX then IY = IXMAX	
IXX = output_amplitude_map_table[IY]	Virtual array with the values of the output amplitude mapping table loaded starting at index 0.
OX = int[(IXX/(ISF*OSF)) + 0.5] + int[(MIN/OSF)+0.5]	Scaled Output Data with scaled image block minimum added.

Where:

IY	Pixel Data from JPEG Expander
IMAX = 4096	
IXMAX = IMAX – 1	Maximum Value for Input to Map Table
ISF = 2**(S1)	Scale Factor Exponent where S1 is a data item included in IOMAPA
OX	Re-scaled Image Pixel Data
OSF = 2**(S2)	Scale Factor Exponent where S2 is a data item included in IOMAPA
MIN	Minimum pixel value for image block extracted from the NITF JPEG application segment APP6/(Extension NITF0001)
OMAX = (IMAX/(ISF*OSF))-1	Maximum Value Clamp for Final Output
int[]	Denotes integer truncation

Note: The resultant output shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.2.2.3 OUTPUT AMPLITUDE MAPPING METHOD 2

Table 9-3 describes the format of the controlled tag extension for amplitude mapping method 2.

If the MAP_SELECT flag is set to 2, a generalized log mapping shall be utilized as the basis for the output amplitude mapping function. The parameters R, S1, S2, and IMAX shall be utilized to generate the function. The parameters R, S1, and S2 shall be extracted from the IOMAPA tag.

The output amplitude mapping process for when the MAP_SELECT set to 2 is defined below:

If IY is less than 0 then IY = 0	Clamp the input to the function.
If IY is greater than IXMAX then IY = IXMAX	
If R is not equal to 1.0	
IX = int[(((exp(IY/B)-1.0)/A)/OSF) + 0.5]	
Else	
IX = int[(IY/(ISF*OSF)) + 0.5]	
OX = IX + int[(MIN/OSF) + 0.5]	Scaled Output Data with Scaled Image Block Minimum Added

Where:

IY	Clamped Pixel Data from JPEG Expander
R	Log Ratio data item from IOMAPA Tag
A = (R-1.0)/IXMID	
B = IXMAX/(ln(1.0+A*ISMAX))	
IXMID = (IMAX/(2*ISF)	Scaled mid-point
ISMAX = (IMAX/ISF)-1	Scaled maximum
IMAX = 4096	IMAX shall be 4096 for 12-bit JPEG/DCT
IXMAX = IMAX – 1	Maximum input
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
OSF = 2**(S2)	Scale Factor (S2 from IOMAPA)
IX	Re-scaled output mapped pixel (with minimum still subtracted)
MIN	Minimum pixel value for image block and included in the NITF JPEG application segment APP6/(Extension NITF0001)
OX	Re-scaled Image Pixel Data
OMAX = (IMAX/(ISF*OSF))-1	Maximum Value for Final Output
int[]	Denotes integer truncation
exp()	Exponential Function (e**x)

Note: The resultant output shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.2.2.4 OUTPUT AMPLITUDE MAPPING METHOD 3

Table 9-4 describes the format of the controlled tag extension for amplitude mapping method 3. Mapping method 3 uses a 3-segment polynomial mapping process where each interval is described by a fifth order polynomial. The break point for each interval and a set of six coefficients defining the polynomial for each segment shall be extracted from the IOMAPA tag.

If the MAP_SELECT flag is set to the value 3, the following segmented polynomial mapping shall be utilized for each pixel output from the expansion process.

The output pixel (IY) from the JPEG/DCT expansion process shall determine which segment of the polynomial function shall be utilized.

Segment (J) shall be defined as

XOB(J-1) <= IY < XOB(J)   For J = 1, 2, and 3

Where

XOB(J) are output mapper segment bounds

XOB(0) = 0 and XOB(3) = 4096

XOB(1) and XOB(2) are extracted from the NITF CDE IOMAPA

The output pixel value (IY) shall be mapped using the coefficients (bi) for the appropriate polynomial segment as defined above. The expression for the polynomial function is given below:

If IY is greater than 4095, then IY = 4095.

If IY is less than 0, then IY = 0.

IZ = IY - XOB(J-1)

IXX = int[b0 + b1*IZ + b2*(IZ**2) + b3*(IZ**3) + b4*(IZ**4) + b5*(IZ**5) + 0.5]

Where the coefficients b0 through b5 are included in the NITF CDE IOMAPA.

The output of the polynomial mapping function (IXX) shall be scaled by the following relationship:

IX = int[(IXX/(ISF*OSF)) + 0.5]

OX = IX + int[(MIN/OSF) + 0.5]

Where:

IY	Pixel value from expansion process (Determines Segment Number Location)
X(J-1)	Lower Boundary for Segment J
b0, b1, b2, ..., b5	6 Output Mapper Coefficients For Segment J { X(J-1) <= IY < X(J) }
IXX	Intermediate value from polynomial equation
IX	Re-scaled output mapped pixel (with minimum still subtracted)
ISF = 2**(S1)	Scale Factor (S1 from IOMAPA)
OSF = 2**(S2)	Scale Factor (S2 from IOMAPA)

OX	Re-scaled Image Pixel Data
MIN	Minimum pixel value for image lock and extracted from the NITF JPEG application segment APP6/(Extension NITF0001)
OMAX = ((IMAX/(ISF*OSF)) - 1)	Final output value clamp
IMAX = 4096	
int[]	Denotes integer truncation

The resultant output (OX) shall then be clamped to ensure that it is greater than or equal to zero and less than or equal to OMAX.

9.1.3 IOMAPA TAGGED RECORD EXTENSION FORMAT TABLES

TABLE 9-1. IOMAPA FORMAT FOR MAPPING METHOD 0
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	00006	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	0	R
S2	Scale Factor 2	2	00 to 11	R

TABLE 9-2. IOMAPA FORMAT FOR MAPPING METHOD 1
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	08202	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	1	R
TABLE_ID	I/O TABLE USED (note 2)	2	00 to 99	0
S1	Scale Factor 1 (note 3)	2	00 to 11	R
S2	Scale Factor 2 (note 4)	2	00 to 11	R
OUTPUT MAP VALUE 0	First Output Mapping Value	2	(note 1)	R
….	………………	..	….	…..
OUTPUT MAP VALUE 4095	Last Output Mapping Value	2	(note 1)	R

Notes:
1. Value is stored in 2 byte unsigned integer format (Most Sign. Byte First). The binary value is limited to be greater than or equal to 0 and less than or equal to 4095.
2. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
3. The value of S1 is used to scale the input data precision up to 12 bits. For the example of 8 bit-input data, the S1 value would be 4.
4. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.

TABLE 9-3. IOMAPA FORMAT FOR MAPPING METHOD 2
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA	5	00016	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	2	R
TABLE_ID	I/O TABLE USED (note 1)	2	00 to 99	0
S1	Scale Factor 1 (note 2)	2	00 to 11	R
S2	Scale Factor 2 (note 3)	2	00 to 11	R
R_WHOLE	R Scaling Factor – Whole Part (note 4)	3	000 to 999	R
R_FRACTION	R Scaling Factor – Fractional Part (note 4)	3	000 to 255	R

Notes:
1. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
2. The value of S1 is used to scale the input data precision up to 12 bits. For the example of 8 bit-input data, the S1 value would be 4.
3. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.
4. The R values contain two parts, the fractional part and the whole part. The resultant of R is derived by the expression: R = R_WHOLE + (R_FRACTION/256)

TABLE 9-4. IOMAPA FORMAT FOR MAPPING METHOD 3
R = Required, O = Optional, and C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	IOMAPA	R
CEL	Length of CEDATA Fields	5	00091	R
BAND_NUMBER	Band Identifier (Band = 000 for Monochrome or Single Band Imagery)	3	000 to 999	R
MAP_SELECT	Mapping Method to Apply	1	3	R
TABLE_ID	I/O TABLE USED (note 1)	2	00 to 99	0
S1	Scale Factor 1 (note 2)	2	00 to 11	R
S2	Scale Factor 2 (note 3)	2	00 to 11	R
NO_OF_SEGMENTS	Number of Segments	1	3	R
XOB_1	Segment Boundary 1	4	0000 to 4095	R
XOB_2	Segment Boundary 2	4	0000 to 4095	R
OUT_B0_1	B0 Coefficient of 1st Segment	4	(note 4)	R
OUT_B1_1	B1 Coefficient of 1st Segment	4	(note 4)	R
OUT_B2_1	B2 Coefficient of 1st Segment	4	(note 4)	R
OUT_B3_1	B3 Coefficient of 1st Segment	4	(note 4)	R
OUT_B4_1	B4 Coefficient of 1st Segment	4	(note 4)	R

TABLE 9-4. IOMAPA FORMAT FOR MAPPING METHOD 3 (CONTINUED)

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
OUT_B5_1	B5 Coefficient of 1st Segment	4	(note 4)	R
OUT_B0_2	B0 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B1_2	B1 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B2_2	B2 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B3_2	B3 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B4_2	B4 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B5_2	B5 Coefficient of 2nd Segment	4	(note 4)	R
OUT_B0_3	B0 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B1_3	B1 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B2_3	B2 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B3_3	B3 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B4_3	B4 Coefficient of 3rd Segment	4	(note 4)	R
OUT_B5_3	B5 Coefficient of 3rd Segment	4	(note 4)	R

Notes:
1. Table_ID is not needed to perform the output mapping function. It is used for diagnostic purposes and can be considered an optional field.
2. The value of S1 is used to scale the input data precision up to 12 bits.
3. The value of S2 is limited to the range where S2 < (12 - S1). Otherwise, all of the data bits would be destroyed.
4. The value is stored in 4-byte IEEE single precision floating point format. Value range is the range available in the standardized 4-byte IEEE single precision floating point format. The 4 bytes are stored in "Network Transmission Order" where the 32 bits are ordered from bit 31 to bit 0 in contiguous order with no byte swapping.

Single-Precision	bit ordering
SIGN	bit 31
EXPONENT	bits 30-23 (bias 127)
FRACTION	bits 22-0

byte 1								byte 2								byte 3			byte 4		
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	…	8	7	…	0
S	E	E	E	E	E	E	E	E	f	f	f	f	f	f	f	f	…	f	f	…	f

10.0 VISIBLE, INFRARED, MULTISPECTRAL (VIMAS) SUPPORT DATA EXTENSION

This section specifies the format and content of a set of CEs for the NITF 2.0 file format. The specified tagged records incorporate all SDEs relevant to visible (EO), infrared (IR), multispectral (MSI), and hyperspectral (HSI) primary imagery. The information that makes up the SDE is derived from referenced interface documents. Systems using EO/IR/MSI/HSI imagery formatted according to NITF2.0 from airborne sensors should be designed to extract the needed data from the tagged records described herein.

10.1 DEFINED SUPPORT DATA EXTENSIONS

Table 10-1 lists the support data extensions described in this document, and whether they are required for all airborne imagery. They are defined for use with EO, infrared IR and MSI collected on airborne sensor platforms. Several are similar to existing and proposed extensions developed by other programs and sensors, including airborne Synthetic Aperture Radar (SAR), and can be considered aliases to those extensions (e.g., AIMIDA is nearly identical with STDIDC used for commercial satellite imagery). Where original fields are not applicable to airborne EO-IR imagery, reserved fields, identified by names of the form “(reserved-nnn)” maintain alignment between the original and alias extensions. Extensions defined for airborne SAR sensors that are applicable to EO-IR sensors are shaded in table 10-1 and are shown in this document only for reference.

TABLE 10-1. AIRBORNE VISIBLE, INFRARED, AND MULTISPECTRAL SUPPORT DATA EXTENSIONS

TAG	TITLE	REQUIREMENT
AIMID	Additional Image Identification	Required
ACFT	Aircraft Information	Required
BLOCK	Image Block Information	Optional
SECTG	Secondary Targeting Info	Optional
BANDS	Multispectral Band Parameters	Optional
EXOPT	Exploitation Usability Optical Information	Optional
MSTGT	Mission Target	Optional
RPC00	Rapid Positioning Data	Optional
SENSR	EO-IR Sensor Parameters	Required
STERO	Stereo Information	Optional

Each tag ends with a revision letter; the initial definition will use the revision letter “A”. Revised tags will have names ending in “B” (“C”,”D”, etc.) as revisions are approved. A transition plan for implementing tag changes shall accompany any such revisions (typically, for a period of time, both the “A” and “B” versions should be supported for receivers of NITF products). SDE fields affected by version changes can contain ASCII blanks (hex 20) for transition between the versions.

The section that describes the purpose of an extension is titled without the revision letter, such that if the extension were to change, the purpose paragraph would not require changing. For example, section 5.3 describes the ACFT or Aircraft Information extension. The actual tag, however, is ACFTA. If in the future, a change is made, section 0 will continue to describe the ACFT or Aircraft Information extensions, but would include a definition of both the ACFTA and ACFTB tagged extensions.

10.2 TECHNICAL NOTES ON COORDINATE SYSTEMS

10.2.1 LOCATIONS

Figure 10-1 shows the earth coordinate frame, the local North-East-Down (NED) coordinate frame, and the platform location parameters: latitude and longitude. The platform location parameters define the location in earth coordinates of the sensor platform, or more specifically, the platform center of navigation. The center of navigation is the origin of the local NED coordinate frame. The local NED coordinates are North (N), East (E), and Down (D) as shown.

The location of the center of navigation within the platform defined uniquely for each platform and sensor.

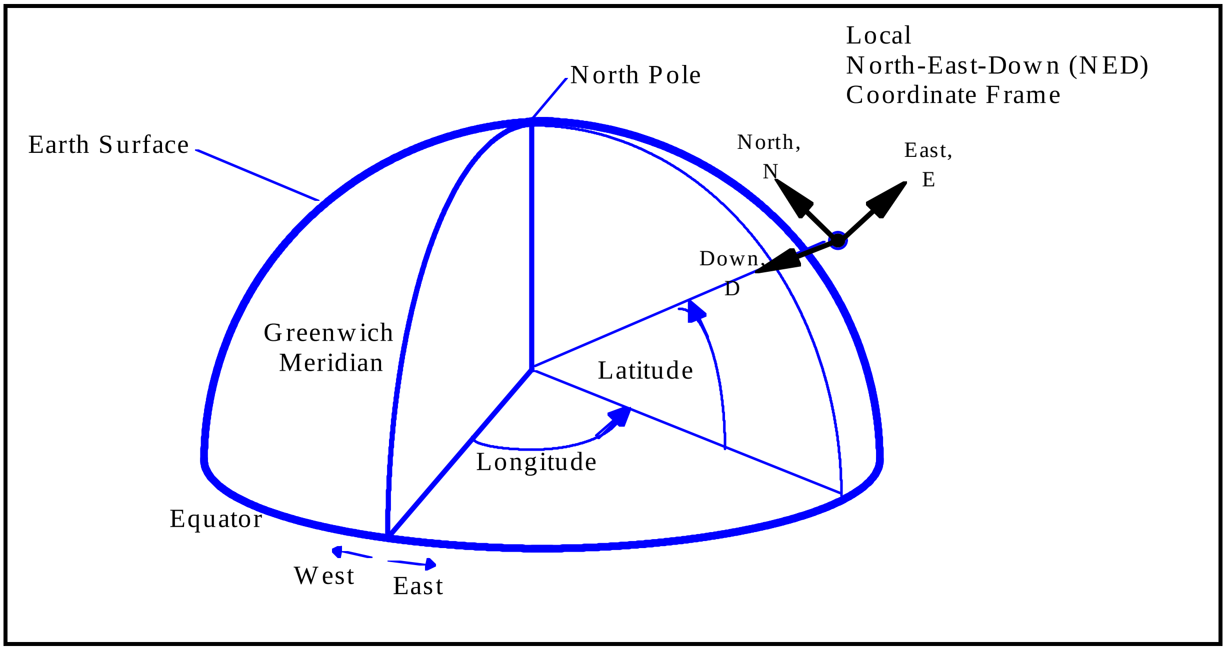

FIGURE 10-1. PLATFORM LOCATION COORDINATES

The earth surface in figure 10-1 is described in the World Geodetic System of 1984 (WGS-84) as two different model surfaces. The two surfaces are an ellipsoid and a geo-id (see figure 10-1). The ellipsoid is an ideal mathematical surface; the geo-id is the mean-sea-level surface of the earth as determined by gravitational potential (elevation of the geo-id relative to the ellipsoid varies with location from -102 to +74 meters). Platform latitude and longitude are referenced to the ellipsoid, while platform altitude mean sea level (MSL) is defined with respect to the geo-id: Altitude MSL is the vertical distance from mean sea level to the platform. The Global Positioning System is referenced to the ellipsoid.

The Down-axis (D) of the NED coordinate frame lies normal to the geo-id. That is, D lies in the direction of gravitational acceleration. The North-axis (N) and East-axis (E) lie in the geometric plane perpendicular to D (the horizontal plane), with N in the direction of True North.

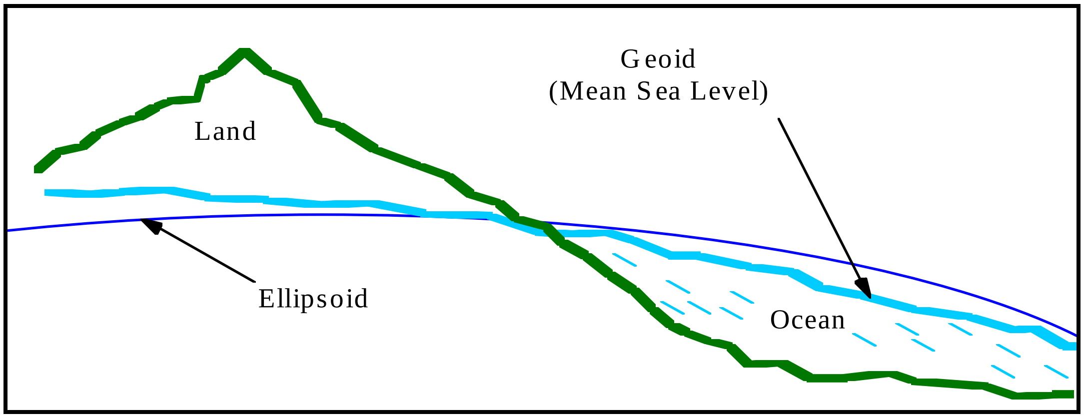

FIGURE 10-2. ELLIPSOID AND GEO-ID MODELS OF THE EARTH SURFACE

10.2.2 ATTITUDE PARAMETERS: HEADING, PITCH, AND ROLL

Heading, pitch, and roll relate the platform body coordinate frame to the local NED frame. Figure 10-3 shows the platform body coordinates. X_a is positive forward, along the roll axis. Y_a is positive right, along the pitch axis. Z_a is positive down, along the yaw axis. The platform body frame, like the local NED frame, has its origin at the center of navigation. Heading is the angle from north to the NED horizontal projection of the platform positive roll axis, X_a (positive from north to east). Pitch is the angle from the NED horizontal plane to the platform positive roll axis, X_a (positive when X_a is above the NED horizontal plane), and is limited to values between ±90 degrees. Roll is the rotation angle about the platform roll axis. Roll is positive if the platform positive pitch axis; Y_a (right wing) lies below the NED horizontal plane.

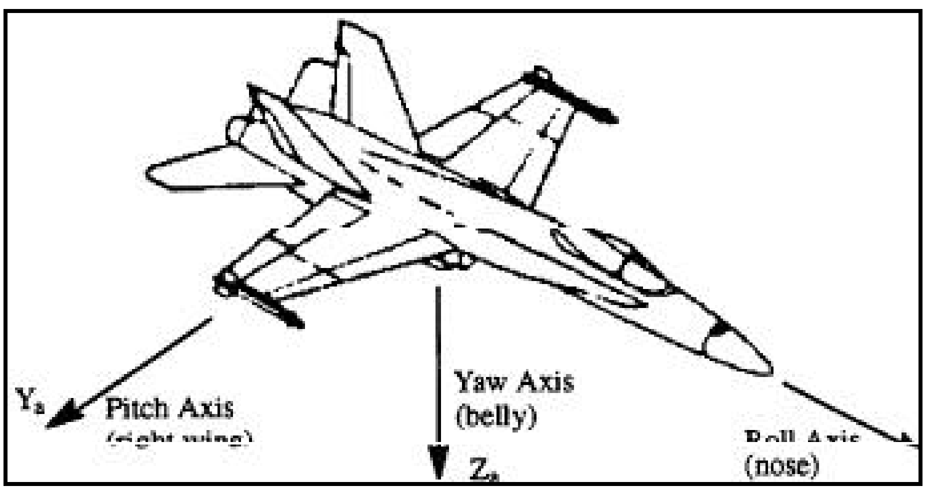

FIGURE 10-3. PLATFORM BODY COORDINATE FRAME

10.3 DETAILED REQUIREMENTS

10.3.1 AIMID - ADDITIONAL IMAGE ID.

The Additional Image ID extension is used for storage and retrieval from standard imagery libraries. AIMID is a required component of all airborne imagery files. The format and description for the user-defined fields of the AIMIDA extension are detailed in table 10-2. A single AIMIDA is placed in the image subheader; where several images relate to a single scene; an AIMIDA may be placed in each applicable image subheader. Note that the fields from ACQUISITION_DATE through END_TILE_ROW, inclusive, constitute the ST_ID field in the STEROB extension of a stereo mate image.

TABLE 10-2. AIMIDA – ADDITIONAL IMAGE ID EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	AIMIDA	N/A	R
CEL	Length of Entire Tagged Record.	5	00089	bytes	R
The following fields define AIMIDA					
ACQUISITION_DATE	Acquisition Date. This field shall contain the date and time, referenced to UTC, of the collection in the format YYYYMMDDhhmmss, in which YYYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). This field is equivalent to the IDATIM field in the image subheader.	14	YYYYMMDDhhmmss		R
MISSION	Mission Identification. Fourteen character descriptor of the mission. Contents are user defined.	14	alphanumeric		R
FLIGHT_NO	Flight Number. A flight number in the range 01 to 09 shall identify each flight. Flight 01 shall be the first flight of the day, flight 02 the second, etc. In order to ensure uniqueness in the image id, if the aircraft mission extends across midnight UTC, the flight number shall be 0x (where x is in the range 0 to 9) on images acquired before midnight UTC and Ax on images acquired after midnight UTC; for extended missions Bx, … Zx shall designate images acquired on subsequent days.	2	01 to 09 A1 to A9 B1 to B9 … Z1 to Z9		R

TABLE 10-2. AIMIDA – ADDITIONAL IMAGE ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
OP_NUM	Image Operation Number. Reset to 001 at the start of each flight. A value of 000 indicates the airborne system does not number imaging operations. For video systems this field contains the frame number within the ACQUISITION_DATE time.	3	000 to 999		R
START_SEGMENT	Start Segment ID. Identifies images as separate pieces (segments) within an imaging operation. AA is the first segment; AB is the second segment, etc.	2	AA to ZZ		R
REPRO_NUM	Reprocess Number. For SAR imagery this field indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A "00" in this field indicates that the data is an originally processed image, a "01" indicates the first reprocess/enhancement, etc. For visible and infrared imagery this field shall contain "00" to indicate no reprocessing or enhancement.	2	00 to 99		R
REPLAY	Replay. Indicates whether the data was reprocessed to overcome initial processing failures, or retransmitted to overcome transmission errors. A "000" in this field indicates that the data is an originally processed and transmitted image, a value in the range of "G01" to "P99" indicates the data is reprocessed, and a value in the range of "T01" to "T99" indicates it was retransmitted.	3	000, G01 to G99, P01 to P99, T01 to T99		<R>
(reserved-001)		1	1 space		R
START_TILE_COLUMN	Starting Tile Column Number. For tiled (blocked) sub-images, the offset of the first tile in the cross-scan direction relative to start of the original image tiling. Tiles are rectangular arrays of pixels that subdivide an image.	3	001 to 999		R

TABLE 10-2. AIMIDA – ADDITIONAL IMAGE ID EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
START_TILE_ROW	Starting Tile Row Number. For tiled (blocked) sub-images, the offset of the first tile in the along-scan direction relative to start of the original image tiling.	5	00001 to 99999		R
END_SEGMENT	Ending Segment. Ending segment ID of this file.	2	AA to ZZ		R
END_TILE_COLUMN	Ending Tile Column Number. For tiled (blocked) sub-images, the offset of the last tile in the cross-scan direction relative to start of the original image tiling.	3	001 to 999		R
END_TILE_ROW	Ending Tile Row Number. For tiled (blocked) sub-images, the offset of the last tile in the along-scan direction relative to start of the original image tiling.	5	00001 to 99999		R
COUNTRY	Country Code. Two letter code defining the country for the reference point of the image. Standard codes may be found in FIPS PUB 10-4.	2	AA to ZZ		<R>
(reserved-002)		4	4 spaces		R
LOCATION	Location of the natural reference point of the sensor provides a rough indication of geographic coverage. The format ddmmX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X = N or S for north or south, and dddmmY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y = E or W for east or west, respectively. For SAR imagery the reference point is normally the center of the first image block. For EO-IR imagery the reference point for framing sensors is the center of the frame; for continuous sensors, it is the center of the first line.	11	ddmmXdddmmY		R
(reserved-003)		13	13 spaces		R

10.3.2 ACFT - AIRCRAFT INFORMATION

ACFT provides miscellaneous information unique to airborne sensors. The format and descriptions for the user-defined fields of the ACFTA extension are detailed in table 10-3. The ACFT extension is required.

TABLE 10-3. ACFTA - AIRCRAFT INFORMATION EXTENSION FORMAT
R = Required, C = conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	ACFTA	N/A	R
CEL	Length of Entire Tagged Record.	5	00191	bytes	R
The following fields define ACFTA					
AC_MSN_ID	Aircraft Mission Identification	20	alphanumeric		R
AC_TAIL_NO	Aircraft Tail Number	10	alphanumeric		<R>
AC_TO	Aircraft Take-off. Date and Time, referenced to UTC, in the format YYYYMMDDhhmm, in which YYYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), and mm is the minute (00 to 59).	12	YYYYMMDDhhmm		<R>
SENSOR_ID	Sensor ID. Identifies which specific sensor produced the image. Examples: For Radar Imagery: ASARS-1 (Advanced SAR on SR-71) ASARS-2 (Advanced SAR on U-2) GHR (Global Hawk Radar) TSAR (Tactical SAR on Predator) For EO-IR, the first four characters of Sensor ID are expressed as ccff where cc indicates the sensor category: IH (High Altitude / Long Range IR) IM (Medium Altitude IR) IL (Low Altitude IR) VH (Visible High Altitude / Long Range) VM (Visible Medium Altitude) VL (Visible Low Altitude) VF (Video Frame) and ff indicates the sensor format: FR (Frame) LS (Line Scan) PB (Pushbroom) PS (Pan Scan)	10	alphanumeric		R

TABLE 10-3. ACFTA - AIRCRAFT INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
SCENE_SOURCE	Scene Source. Indicates the origin of the request for the current scene. A scene is single image or a collection of images providing contiguous coverage of an area of interest. 0 = Pre-Planned 1 to 9 = Sensor Specific: For ASARS-2: 1 = Scene Update (uplink) 2 = Scene Update (manual - via pilot's cockpit display unit) 3 = Immediate Scene (immediate spot or search range adjust) 5 = Preplanned Tape Modification 6 = SSS Other Sensors: TBD.	1	0 to 9		R
SCNUM	Scene Number. Identifies the current scene, and is determined from the mission plan; except for immediate scenes, where it may have the value 0, the scenes are numbered from 1. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.	6	000000 to 999999		R
PDATE	Processing Date. SAR: when raw data is converted to imagery. EO-IR: when image file is created. YYYY is the year, MM is the month (01–12), and DD is the day of the month (00 to 31). This date changes at midnight UTC.	8	YYYYMMDD		R

TABLE 10-3. ACFTA - AIRCRAFT INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
IMHOSTNO	Immediate Scene Host. Together with Immediate Scene Request ID below, denotes the scene that the immediate was initiated from and can be used to renumber the scene, Example: If the immediate scene was initiated from scene number 123 and this is the third request from that scene, then the scene number field will be zero, the immediate scene host field will contain 123 and the immediate scene request id will contain 3. Only valid for immediate scenes.	6	000000 to 000511		<R>
IMREQID	Immediate Scene Request ID	5	00000 to 32767		<R>
MPLAN	Mission Plan Mode. Defines the current collection mode. For ASARS-1: 001 to 005 = Search, submodes 1 to 5 006 to 010 = Op Spot, submodes 1 to 5 011 to 015 = Wideband Spot, submodes 1 to 5 For ASARS-2: 001 – Search 002 – Spot 3 004 – Spot 1 007 – Continuous Spot 3 008 – Continuous Spot 1 009 – EMTI Wide Frame Search 010 – EMTI Narrow Frame Search 011 – EMTI Augmented Spot 012 – EMTI Wide Area MTI (WAMTI) 013 – Monopulse Calibration For EO-IR: 001 to 003 – Reserved 004 to EO Spot 005 to EO Point Target 006 to EO Wide Area Search 014 to IR Spot 015 to IR Point Target 016 to IR Wide Area Search	3	001 to 016		R

TABLE 10-3. ACFTA - AIRCRAFT INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
In SAR Search mode and EO-IR Wide Area Search modes, the entry and exit locations are the specified latitude, longitude and altitude above mean sea level (MSL) of the planned entry and exit points on the scene centerline of the area to be imaged. In EO-IR and SAR Spot modes, and EO-IR Point Target modes, the entry location is the specified reference point latitude/longitude/altitude, and the exit location is not used. The location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).					
ENTLOC	Entry Location.	21	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd		<R>
ENTALT	Entry Altitude.	6	-01000 to +30000	feet or meters	<R>
ALT_UNIT	Unit of Altitude. Defines unit for Entry and Exit Altitudes. f=feet, m=meters	1	f or m		<R>
EXITLOC	Exit Location.	21	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd		<R>
EXITALT	Exit Altitude.	6	-01000 to +30000	feet or meters	<R>
TMAP	True Map Angle. SAR: In Search modes, the true map angle is the angle between the ground projection of the line of sight from the aircraft and the scene centerline. In Spot modes, the true map angle is the angle, measured at the central reference point, between the ground projection of the line of sight from the aircraft and a line parallel to the aircraft desired track heading. EO-IR: The true map angle is defined in the NED coordinate system with origin at the aircraft (aircraft local NED), as the angle between the scene entry line of sight and the instantaneous aircraft track heading vector. The aircraft track-heading vector is obtained by rotating the north unit vector of the aircraft local NED coordinate system in the aircraft local NE plane through the aircraft track-heading angle. The true map angle is measured in the slanted plane containing the scene entry line of sight and the aircraft track-heading vector. This angle is always positive.	7	000.000 to 180.000	degrees	<R>

TABLE 10-3. ACFTA - AIRCRAFT INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
ROW_SPACING	Row Spacing SAR: Ground plane distance between corresponding pixels of adjacent rows, measured in feet. EO-IR: Angle between corresponding pixels of adjacent rows, measured in microradians at center of image.	7	SAR: 00.0000 to 99.9999 EO-IR:0000.00 to 9999.99	ft µ-radians	<R>
COL_SPACING	Column Spacing SAR: Ground plane distance between adjacent pixels within a row, measured in feet. EO-IR: Angle between adjacent pixels within a row, measured in microradians at center of image.	7	SAR: 00.0000 to 99.9999 EO-IR:0000.00 to 9999.99	ft µ-radians	<R>
FOCAL_LENGTH	Sensor Focal Length. Effective distance from optical lens to sensor element(s). Not used for SAR.	6	SAR: 999.99 EO-IR: 000.01 to 999.99	cm	<R>
SENSERIAL	Sensor vendor's serial number. Serial number of the line replaceable unit (LRU) containing EO-IR imaging electronics or SAR Receiver/Exciter involved in creating the imagery contained in this file.	6	000001 to 999999		<R>
ABSWVER	Airborne Software Version. Airborne software version (vvvv) and Revision (rr) numbers.	7	vvvv.rr		<R>
CAL_DATE	Calibration Date. Date sensor was last calibrated. YYYY is the year, MM is the month (01–12), and DD is the day of the month (00 to 31).	8	YYYYMMDD		<R>
PATCH_TOT	Patch Table. Total Number of Patches contained in this file, and therefore, the number of PATCH extensions. Not used for EO-IR imagery.	4	SAR: Spot: 0000 to 0001 Search: 0001 to 0999 EO-IR: 0000		R
MTI_TOT	MTI Total. Total Number of MTIRP extensions contained in this file. Each MTIRP identifies 1 to 256 moving targets. Not used for EO-IR imagery.	3	SAR: 000 to 999 EO-IR: 0000		R

10.3.3 BLOCK - IMAGE BLOCK INFORMATION

Image Block Information is optional, but often needed for exploitation of imagery. The format for the user defined fields of the BLOCKA extension and a description of their contents is detailed in table 10-4. BLOCK is placed in the image subheader. Where several image subheaders relate to a single scene, BLOCKA is placed in the first image subheader.

TABLE 10-4. BLOCKA – IMAGE BLOCK INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	BLOCKA	N/A	R
CEL	Length of Entire Tagged Record.	5	00123	bytes	R
The following fields define BLOCKA					
BLOCK_INSTANCE	Block number of this image block.	2	01 to 99		R
N_GRAY	SAR: The number of gray fills samples. EO-IR: spaces	5	00000 to 99999 spaces		<R>
L_LINES	Line count.	5	00001 to 99999		R
LAYOVER_ANGLE	Layover Angle. SAR: The angle between the first row of pixels and the layover direction in the image; positive values indicate a clockwise direction, defaults to spaces. EO-IR: spaces.	3	000 to 359, spaces	degrees	<R>
SHADOW_ANGLE	Shadow Angle. SAR: The angle between the first row of pixels and the radar shadow in the image; positive values indicate a clockwise direction, defaults to spaces. EO-IR: spaces.	3	000 to 359, spaces	degrees	<R>
(reserved-004)		16	16 spaces		R
The following four fields repeat earth coordinates image corner locations described by IGEOLO in the NITF image subheader, but provide higher precision. The format Xddmmss.cc represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and Ydddmmss.cc represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).					
FRLC_LOC	First Row Last Column Location. Location of the first row, last column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd		R
LRLC_LOC	Last Row Last Column Location. Location of the last row, last column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd		R
LRFC_LOC	Last Row First Column Location. Location of the last row, first column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd		R
FRFC_LOC	First Row First Column Location. Location of the first row, first column of the image block.	21	Xddmmss.ssYdddmmss.ss, ±dd.dddddd±ddd.dddddd		R
(reserved-005)		5	010.0		R

10.3.4 SECTG - SECONDARY TARGETING INFORMATION

Secondary Targeting Information supports retrieval of imagery from automated libraries. Use of SECTG is optional. The format and descriptions for the user-defined fields of the SECTGA extension are detailed in table 10-5. As many as ten SECTGA extensions can exist in a single NITF file, with the N_SEC field of EXPLTA providing the total count. Either SEC_ID, SEC_BE, or both must contain a valid identifier.

TABLE 10-5. SECTGA – SECONDARY TARGETING INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	SECTGA	N/A	R
CEL	Length of Entire Tagged Record.	5	00028	bytes	R
The following fields define SECTGA					
SEC_ID	Designator of Secondary Target	12	alphanumeric		<R>
SEC_BE	Basic Encyclopedia ID of secondary target, including the five characters Target Category of the expanded BE.	15	alphanumeric		<R>
(reserved-006)		1	0		R

10.3.5 BANDS - MULTISPECTRAL BAND PARAMETERS

The BAND extension is defined to replace or supplant information in the NITF image subheader where additional parametric data is required, or where an image contains more than 9 spectral bands. This data extension is placed in each image subheader as required. The format and descriptions of the user-defined fields of this are detailed in table 10-6. Each Band must be identified either by the wavelength of peak response (BANDPEAK), or the wavelengths of its edges (BANDLBOUNDn, BANDUBOUNDn).

TABLE 10-6. BANDSA – MULTISPECTRAL BAND PARAMETERS EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	BANDSA	N/A	R
CEL	Length of Entire Tagged Record.	5	00050 – 45958	bytes	R
The Following Fields Define DECIMA					
BANDCOUNT	Number of Bands comprising the image. Fields BANDPEAKn through BANDGSDn will be repeated for each band.	4	0001 to 0999	N/A	R
BANDPEAKn	Band n Peak Response Wavelength. Must be specified unless BANDLBOUNDn and BANDUBOUNDn are specified.	5	00.01 to 19.99	µm	<C>
BANDLBOUNDn	Band n Lower Wavelength Bound. The wavelength for the nth band at the lower 50% (-3db) point of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDUBOUNDn	Band n Upper Wavelength Bound. The wavelength for the nth band at the higher 50% (-3db) point of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDWIDTHn	Band n Width. The wavelength difference between the upper and lower bounds at the 50% (-3db) points of the sensor spectral response.	5	00.01 to 19.99	µm	<C>
BANDCALDRKn	Band n Calibration (Dark). The calibrated receive power level for the nth band that corresponds to a pixel value of 0.	6	0000.1 to 9999.9	µw / (cm^2-sr-µm)	<C>
BANDCALINCn	Band n Calibration (Increment). The mean change in power level for the nth band that corresponds to an increase of 1 in pixel value.	5	00.01 to 99.99	µw / (cm^2-sr-µm)	<C>
BANDRESPn	Band n Spatial Response. Nominal pixel size, expressed in microradians	5	000.1 to 999.9	µradians	<C>
BANDASDn	Band n Angular Sample Distance. The pixel center to center distance, expressed in microradians.	5	000.1 to 999.9	µradians	<C>
BANDGSDn	Band n Ground Sample Distance. The average distance between adjacent pixels for the nth band.	5	00.01 to 99.99	m	<C>

10.3.6 EXOPT - EXPLOITATION USABILITY OPTICAL INFORMATION

The Exploitation Usability Optical Information extension is optional. EXOPT provides metadata that allows a user program to determine if the image is suitable for the exploitation problem currently being performed. It contains some of the fields, which would make up a NIMA standard directory entry. The format and descriptions for the user-defined fields of the EXOPTA are detailed in table 10-7. A single EXOPT is placed in the image subheader, following AIMID.

TABLE 10-7. EXOPTA – EXPLOITATION USABILITY OPTICAL INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	EXOPTA	N/A	R
CEL	Length Data Fields.	5	00107	bytes	R
The following fields define EXOPTA					
ANGLE_TO_NORTH	Angle to True North. Measured clockwise from first row of the image.	3	000 to 359	degrees	R
MEAN_GSD	Mean Ground Sample Distance. The geometric mean of the cross and along scan center-to-center distance between contiguous ground samples. Accuracy = ±10% Note: Systems requiring an extended range shall insert a default value of “000.0” for this field and utilize the PIAMC tag.	5	000.0 to 999.9	inches	R
(reserved-007)		1	1		R
DYNAMIC_RANGE	Dynamic Range of image pixels.	5	00000 to 65535		<R>
(reserved-008)		7	7 spaces		R
OBL_ANG	Obliquity Angle. Angle between the local NED horizontal and the optical axis of the image.	5	00.00 to 90.00	degrees	<R>
ROLL_ANG	Roll Angle of the platform body.	6	±90.00	degrees	<R>
PRIME_ID	Primary Target ID	12	alphanumeric		<R>
PRIME_BE	Primary Target BE	15	alphanumeric		<R>
(reserved-009)		5	5 space		R
N_SEC	Number Of Secondary Targets in Image. Determines the number of SECTG extension present.	3	000 to 250		R
(reserved-010)		2	2 spaces		R
(reserved-011)		7	0000001		R

TABLE 10-7. EXOPTA – EXPLOITATION USABILITY OPTICAL INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
N_SEG	Number of Segments. Segments are separate imagery pieces within an imaging operation.	3	001 to 999		R
MAX_LP_SEG	Maximum Number of Lines Per Segment. Includes overlap lines.	6	000001 to 199999		<R>
(reserved-012)		12	12 spaces		R
SUN_EL	Sun Elevation. Angle in degrees, measured from the target plane at intersection of the optical line of sight with the earth's surface at the time of the first image line. 999.9 indicates data is not available.	5	±90.0, 999.9	degrees	R
SUN_AZ	Sun Azimuth. Angle in degrees, from True North clockwise (as viewed from space) at the time of the first image line. 999.9 indicates data is not available.	5	000.0 to 359.9, 999.9	degrees	R

10.3.7 MSTGT - MISSION TARGET INFORMATION

MSTGT provides information from the collection plan associated with the image, and should identify specific targets contained within the image (however, due to collection geometry, a referenced target may not actually correspond to the area contained in the image). Use of MSTGT is optional. The format and description of the user-defined fields of MSTGTA are given in table 10-8. As many as 256 instances of this data extension may occur in each NITF file.

TABLE 10-8. MSTGTA – MISSION TARGET INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	MSTGTA	N/A	R
CEL	Length of Entire Tagged Record.	5	00072	bytes	R
The Following Fields Define MSTGTA					
TGT_NUM	Pre-Planned Target Number. A number assigned to each preplanned target, initialized at 1. Recorded in the mission target support data block and the mission catalog support data block to associate the two groups of information. The same number may be assigned to multiple mission catalogs support blocks. Each mission target block shall have a unique number.	3	001 to 999		R
TGT_PRI	Pre-Planned Target Priority: 1 = top priority 2 = second, etc.	3	001 to 999		<R>
TGT_REQ	Target Requester. Identification of authority requesting targets image.	12	alphanumeric		<R>
TGT_LTIOV	Latest Time Information of Value. This field shall contain the date and time, referenced to UTC, at which the information contained in the file, loses all value and should be discarded. The date and time is in the format YYYYMMDDhhmmZ, in which YYYY is the year, MM is the month (01–12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59).	12	YYYYMMDDhhmm		<R>
TGT_TYPE	Pre-Planned Target Type: 0 = point 1 = strip 2 = area	1	0 to 9		<R>

TABLE 10-8. MSTGTA – MISSION TARGET INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
TGT_COLL	Pre-Planned Collection Technique: 0 = vertical 1 = forward oblique 2 = right oblique 3 = left oblique 4 = best possible 5 to 9 = reserved	1	0 to 9		R
TGT_CAT	Target Functional Category Code from DIAM-65-3-1. The five character numeric code classifies the function performed by a facility. The data code is based on an initial breakdown of targets into nine major groups, identified by the first digit: 1 Raw Materials 2 Basic Processing 3 Basic Equipment Production 4 Basic Services, Research, Utilities 5 End Products (civilian) 6 End Products (military) 7 Places, Population, Gov't 8 Air & Missile Facilities 9 Military Troop Facilities Each successive numeric character, reading from left to right, extends or delineates the definition further.	5	10000 to 99999		<R>
TGT_UTC	UTC at Target. Format is hhmmssZ: hh = Hours, h = Minutes, ss = Secs, Z = time zone.	7	hhmmssZ		R
TGT_ELEV	Target Elevation, MSL. Planned elevation of point target. For strip and area targets, this corresponds to the average elevation of the target area. Measured in feet or meters, as specified by TGT_ELEV_UNIT.	6	-01000 to +30000	feet or meters	R
TGT_ELEV_UNIT	Unit of Target Elevation. f = feet, m=meters.	1	f or m		

TABLE 10-8. MSTGTA – MISSION TARGET INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
TGT_LOC	Target Location. Planned latitude/ longitude of corresponding portion of target. Location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).	21	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd		R

10.3.8 RPC00 - RAPID POSITIONING CAPABILITY

RPC00 contains rational function polynomial coefficients and normalization parameters that define the physical relationship between image coordinates and ground coordinates. Use of RPC00 is optional. The format and descriptions for the user-defined fields of the RPC00A extension is detailed in table 10-9. A discussion of the polynomial functions is contained in Section 10.4.

TABLE 10-9. RPCOOA – RAPID POSITIONING CAPABILITY EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	RPCOOA		R
CEL	Length of Entire Tagged Record.	5	01041	bytes	R
The following fields define RPC00A					
SUCESS		1	1		R
ERR_BIAS	Error - Bias. 68% non time-varying error estimate assumes correlated images.	7	0000.00 to 6553.50	meters	R
ERR_RAND	Error - Random. 68% time-varying error estimate assumes correlated images.	7	0000.00 to 6553.50	meters	R
LINE_OFF	Line Offset	6	000000 to 524287	pixels	R
SAMP_OFF	Sample Offset	5	00000 to 54144	pixels	R
LAT_OFF	Geodetic Latitude Offset	8	±90.0000	degrees	R
LONG_OFF	Geodetic Longitude Offset	9	±180.0000	degrees	R
HEIGHT_OFF	Geodetic Height Offset	5	±8000	meters	R
LINE_SCALE	Line Scale	6	000001 to 524287	pixels	R
SAMP_SCALE	Sample Scale	5	00001 to 54144	pixels	R
LAT_SCALE	Geodetic Latitude Scale (cannot be ±00.0000)	8	±90.0000	degrees	R
LONG_SCALE	Geodetic Longitude Scale (cannot be ±000.0000)	9	±180.0000	degrees	R
HEIGHT_SCALE	Geodetic Height Scale (cannot be ±0000)	5	±8000	meters	R
LINE_NUM_COEFF_1 (through) LINE_NUM_COEFF_20	Line Numerator Coefficients. Twenty coefficients for the polynomial in the Numerator of the r_n equation.	12 --- 12	±0.524287E±7 --- ±0.524287E±7		R --- R
LINE_DEN_COEFF_1 (through) LINE DEN_COEFF_20	Line Denominator Coefficients. Twenty coefficients for the polynomial in the Denominator of the r_n equation.	12 --- 12	±0.524287E±7 --- ±0.524287E±7		R --- R
SAMP_NUM_COEFF_1 (through) SAMP_NUM_COEFF_20	Sample Numerator Coefficients. Twenty coefficients for the polynomial in the Numerator of the c_n equation.	12 --- 12	±0.524287E±7 --- ±0.524287E±7		R --- R
SAMP_DEN_COEFF_1 (through) SAMP_DEN_COEFF_20	Sample Denominator Coefficients. Twenty coefficients for the polynomial in the Denominator of the c_n equation.	12 --- 12	±0.524287E±7 --- ±0.524287E±7		R --- R

10.3.9 SENSR - EO-IR SENSOR PARAMETERS

The SENSR provides information about the sensor and its installation. The SENSR extension is required. The format and descriptions for the user-defined fields of the SENSR extension are detailed in table 10-10. Imaging operations that require substantial time, for example push broom sensors, may require multiple SENSR extensions to adequately describe imaging geometry. The SENSR extension(s) are placed in the image subheader.

TABLE 10-10. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT
R = Required, C = Conditional, <> = Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	SENSRA	N/A	R
CEL	Length of Entire Tagged Record.	5	00128	bytes	R
The Following Fields Define SENSRA:					
REF_ROW	Reference Row. Data in this extension was collected at REF_ROW, REF_COL of the imaging operation. Identifies the time at which the data was valid during extended imaging operations.	8	00000000 to 99999999		<R>
REF_COL	Reference Column	8	00000000 to 99999999		<R>
SENSOR_MODEL	Sensor Model Name	6	alphanumeric		<R>
SENSOR_MOUNT	Sensor Mounting Pitch Angle. Angle in degrees between the longitudinal centerline of the platform and the sensor scan axis. Normally only applicable to push broom sensors.	3	±45	degrees	<R>
SENSOR_LOC	Sensor Location. The earth coordinate sensor location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of latitude, with X = N for north or S for south, and dddmmss.ssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and hundredths of seconds (00 to 99) of longitude, with Y = E for east or W for west. The format ±dd.dddddd indicates degrees of latitude north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).	21	ddmmss.ssXdddmmss.ssY ±dd.dddddd±ddd.dddddd	N/A	R

TABLE 10-10. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
SENSOR_ALT	Sensor GPS Altitude. Measured in feet or meters, as specified by SENSOR_ALT_UNIT.	6	-01000 to +99000	feet or meters	<R>
SENSOR_ALT_UNIT	Unit of Sensor Altitude. Applies to both SENSOR_ALT and SENSOR_AGL, and may only be null if both altitudes are null. f = feet, m =meters	1	f or m		<R>
SENSOR_AGL	Sensor Radar Altitude. Measured in feet or meters, as specified by SENSOR_ALT_UNIT. Filled with spaces when not available, or outside equipment operating range.	5	00010 to 99000	feet or meters	<R>
SENSOR_PITCH	Sensor Pitch Angle. Angular position of the sensor optical axis, about the platform pitch axis. For push broom sensors, the angle between the platform roll axis Xa and the projection of the sensor scan axis onto the Xa, Za plane.	7	±90.000	degrees	<R>
SENSOR_ROLL	Sensor Roll Angle. Angular position of the sensor optical axis, about the platform roll axis.	8	±180.000	degrees	<R>
SENSOR_YAW	Sensor Yaw Angle. Angular position of the sensor optical axis, about the platform yaw axis.	8	±180.000	degrees	<R>
PLATFORM_PITCH	Platform Pitch.	7	±90.000	degrees	<R>
PLATFORM_ROLL	Platform Roll	8	±180.000	degrees	<R>
PLATFORM_HDG	Platform Heading.	5	000.0 to 359.9	degrees	<R>
GROUND_SPD	Ground Speed.	6	0000.0 to 9999.9		<R>
GROUND_SPD_UNIT	Unit of Ground Speed. May be null only if GROUND_SPD is null. k =knots, f =feet/sec., m =meters/sec.	1	k, f, or m		<R>
GROUND_TRACK	Ground Track. The angle from north to the horizontal projection of the platform path (positive from north to east).	5	000.0 to 359.9	degrees	<R>
VERT_VEL	Vertical Velocity. Measured in either feet/min. or meters/min. as specified by VERT_VEL_UNIT.	5	±9999	feet or meters per min	<R>
VERT_VEL_UNIT	Unit of Vertical Velocity. May be null only if VERT_VEL is null. f =feet/min., m =meters/min.	1	f or m		<R>

TABLE 10-10. SENSRA – EO-IR SENSOR PARAMETERS EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
SWATH_FRAMES	Number of Frames per Swath. Swath is a continuous strip of frames swept out by the scanning motion of certain dynamic sensors.	2	01 to 99		<R>
N_SWATHS	Number of Swaths.	4	0001 to 9999		<R>
SPOT_NUM	Spot Number. Number in point targets mode.	3	001 to 999		<R>

10.3.10 STERO — STEREO INFORMATION.

The STERO extension provides links between several images that form a stereo set to allow exploitation of elevation information. Use of STERO is optional. There can be up to 3 STREO extensions per image. The format and descriptions for the User Defined fields of the STREO extension is detailed in table 10-11. The two images comprising a Stereo Pair are referred to as the *Left* and *Right* images; the Beginning and Ending Asymmetry, Convergence, and Bisector Elevation angles define the geometry between the two images (figure 10-5). The Beginning and Ending angles are always measured from the first and last lines, respectively, of the Left image, but measurement locations in the Right image are dependent on the rotation required to align the imagery (figure 10-4). When the two images are collected in succession along a flight path, the fore (aft) image is the Left (Right) image.

TABLE 10-11. STEROB – STEREO INFORMATION EXTENSION FORMAT
R = Required, C = Conditional, <> Null Data Allowed

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
CETAG	Unique Extension Identifier.	6	STEROB	N/A	R
CEL	Length of Entire Tagged Record.	5	00094	bytes	R
The Following Fields Define STEROB:					
ST-ID	Stereo Mate. The image id of the first stereo mate. This field contains the values of the fields ACQUISITION_DATE through END_TIL_ROW in the AIMID extension of the stereo mate image.	60	alphanumeric		R
N MATES	Number of Stereo Mates. If there are no stereo mates, there will be no STERO extensions in the file. If there is a STREO extension, then there will be at least 1 stereo mate.	1	1 to 3		R
MATE_INSTANCE	Mate Instance. Identifies which stereo mate is described in this extension. For example, this field would contain a 2 for the second stereo mate.	1	1 to 3		R
B_CONV	Beginning Convergence Angle. Defined at the first lines of the left and /right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the last line of the right shall be used.	5	00.00 to 90.00	degrees	<R>
E_CONV	Ending Convergence Angle. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right shall be used.	5	00.00 to 90.00	degrees	<R>

TABLE 10-11. STEROB – STEREO INFORMATION EXTENSION FORMAT (CONTINUED)

FIELD	NAME	SIZE	VALUE RANGE	UNITS	TYPE
B_ASYM	Beginning Asymmetry Angle. Defined at the first lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, last line of the right shall be used.	5	00.00 to 90.00	degrees	<R>
E_ASYM	Ending Asymmetry Angle. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right shall be used.	5	00.00 to 90.00	degrees	<R>
B_BIE	Beginning Bisector Intercept Elevation less Convergence Angle of Stereo Mate. Defined at the first lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the last line of the right shall be used.	6	±90.00	degrees	<R>
E_BIE	Ending Bisector Intercept Elevation less Convergence Angle of Stereo Mate. Defined at the last lines of the left and right images, unless those images are rotated more than 90 degrees to each other; If the images are rotated more than 90 degrees to each other, the first line of the right shall be used.	6	±90.00	degrees	<R>

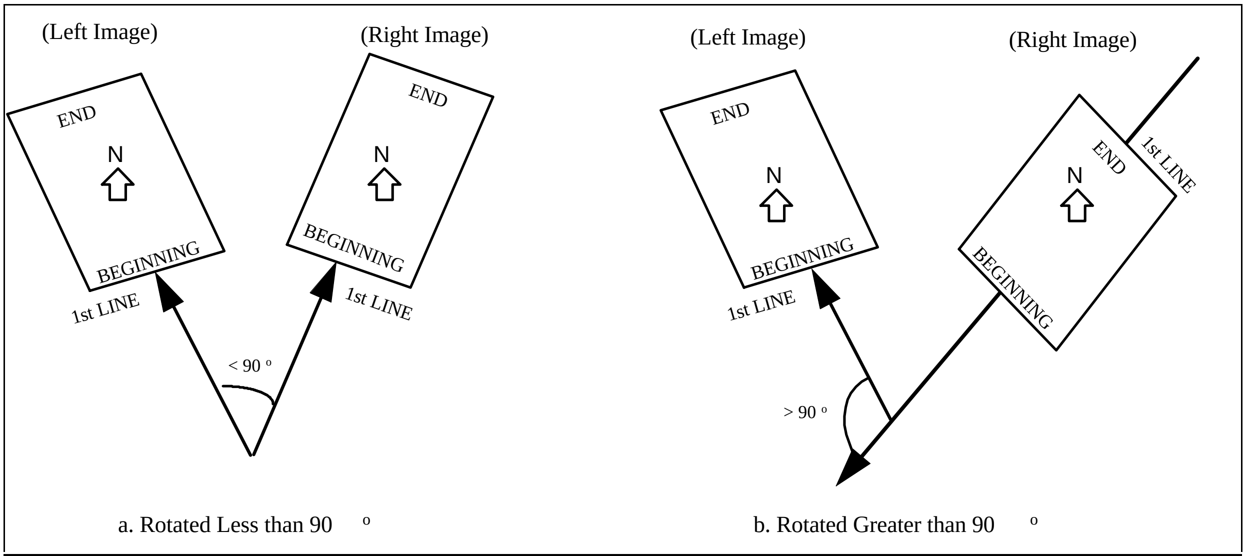

FIGURE 10-4. LOCATION OF BEGINNING/ENDING ANGLES

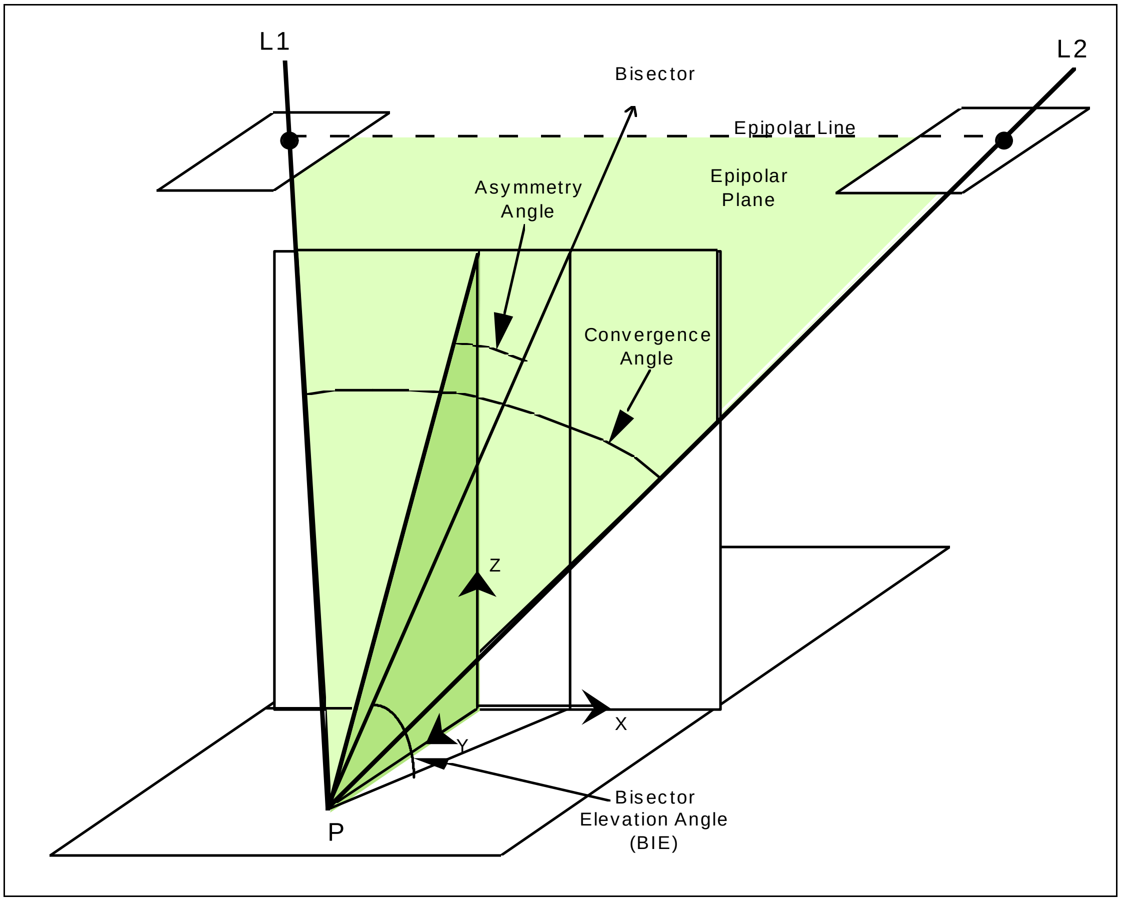

FIGURE 10-5 ASYMMETRY ANGLE, CONVERGENCE ANGLE AND BISECTOR ELEVATION ANGLE

10.4 NOTES

10.4.1 PROJECTION MODEL FOR RPC00.

The geometric sensor model describing the relationship between image coordinates and ground coordinates is known as a Rigorous Projection Model (RPM). The RPM expresses the mapping of the image space coordinates of rows and columns (r,c) onto the object space reference surface geodetic coordinates (j , l , h).

The RPM approximation used by RPC00 is a set of rational polynomials expressing the normalized row and column values, (r_n, c_n), as a function of normalized geodetic latitude, longitude, and height, (P, L, H), given a set of normalized polynomial coefficients (LINE_NUM_COEF_n, LINE_DEN_COEF_n, SAMP_NUM_COEF_n, SAMP_DEN_COEF_n). Normalized values, rather than actual values are used in order to minimize introduction of errors during the calculations. The transformation between row and column values (r,c), and normalized row and column values (r_n, c_n), and between the geodetic latitude, longitude, and height (j , l , h), and normalized geodetic latitude, longitude, and height (P, L, H), is defined by a set of normalizing translations (offsets) and scales that ensure all values are contained in the range -1 to +1.

P = (Latitude - LAT_OFF) ÷ LAT_SCALE
L = (Longitude - LONG_OFF) ÷ LONG_SCALE
H = (Height - HEIGHT_OFF) ÷ HEIGHT_SCALE
r_n = (Row - LINE_OFF) ÷ LINE_SCALE
c_n = (Column - SAMP_OFF) ÷ SAMP_SCALE

The rational function polynomial equations are defined as:

$$r_n = \frac{\sum_{i=1}^{20} LINE\_NUM\_COEF_i \cdot r_i(P,L,H)}{\sum_{i=1}^{20} LINE\_DEN\_COEF_i \cdot r_i(P,L,H)} \quad \text{and} \quad c_n = \frac{\sum_{i=1}^{20} SAMP\_NUM\_COEF_i \cdot r_i(P,L,H)}{\sum_{i=1}^{20} SAMP\_DEN\_COEF_i \cdot r_i(P,L,H)}$$

The rational function polynomial equation numerators and denominators each are 20-term cubic polynomial functions of the form:

$$\begin{aligned}\sum_{i=1}^{20} C_i \cdot r_i(P,L,H) = {} & C_1 && + C_6 \cdot L \cdot H && + C_{11} \cdot P \cdot L \cdot H && + C_{16} \cdot P^3 \\ & + C_2 \cdot L && + C_7 \cdot P \cdot H && + C_{12} \cdot L^3 && + C_{17} \cdot P \cdot H^2 \\ & + C_3 \cdot P && + C_8 \cdot L^2 && + C_{13} \cdot L \cdot P^2 && + C_{18} \cdot L^2 \cdot H \\ & + C_4 \cdot H && + C_9 \cdot P^2 && + C_{14} \cdot L \cdot H^2 && + C_{19} \cdot P^2 \cdot H \\ & + C_5 \cdot L \cdot P && + C_{10} \cdot H^2 && + C_{15} \cdot L^2 \cdot P && + C_{20} \cdot H^3\end{aligned}$$

where coefficients $C_1 \cdots C_{20}$ represent the following sets of coefficients:
LINE_NUM_COEF_n, LINE_DEN_COEF_n, SAMP_NUM_COEF_n, SAMP_DEN_COEF_n

The image coordinates are in units of pixels. The ground coordinates are latitude and longitude in units of decimal degrees and the geodetic elevation in units of meters. The ground coordinates are referenced to WGS-84.

11.0 BCKGDA CONTROLLED EXTENSION

This extension is used for scaling NITF images and overlays for the purposes of printing and for setting background color. It provides information needed to print and scale the displayable part of an NITFS file.

11.1 BCKGDA FIELD FORMATS

TABLE 11-1. BCKGDA - FIELD SIZES AND DEFINITIONS
R = Required, C = Conditional

FIELD	NAME	SIZE	RANGE	TYPE
CETAG	Tag Name	6	BCKGDA	R
CEL	Length of Extension Tag	5	00099	R
BGWIDTH	Background Width. The width, in PIXUNITS, of the complete NITF composition (This is not CLEVEL size, this is the composition (e.g. -paper size))	8	00000000 to 99999999	R
BGHEIGHT	Background Height. The HEIGHT, in PIXUNITS, of the complete NITF composition (This is not CLEVEL size, this is the composition (e.g. -paper size))	8	00000000 to 99999999	R
BGRED	Background Red. The red component of the background	8	00000000 to 00000255	R
BGGREEN	Background Green. The green component of the background	8	00000000 to 00000255	R
BGBLUE	Background Blue. The blue component of the background	8	00000000 to 00000255	R
PIXSIZE	Pixel Size. The number of pixels per PIXUNITS: "INCHES or CENTIMETERS only	8	00000000 to 99999999	R
PIXUNITS	Pixel Units. The unit of measure for printing of a pixel of the NITF composition	40	alphanumeric: DEVICE, PIXELS, INCHES, CENTIMETERS, or POINTS	R

Note: The PIXSIZE is defined for PIXUNITS of INCHES or CENTIMETERS only.

If the PIXSIZE is 100 and the PIXUNITS is "INCHES" the NITF composition units of measure for printing is 100 pixels per inch (The same logic holds true for "CENTIMETERS").

If the PIXUNITS is "DEVICE PIXELS" then the composition is output to the print device with a one to one pixel correspondence.

If the PIXUNITS is POINTS then the composition units of measure for printing is 72 pixels per inch or 28.3464 pixels per centimeter.

12.0 NBLOCA TAGGED RECORD EXTENSION

NBLOCA et of each image frame relative to each other within a NITF image. The first image frame offset is the number of bytes in the image subheader. All of the other offsets are the number of bytes in the previous image block or frame.

This extension allows the NITF image to be accessed in a random or parallel fashion by providing the ability to find the offset to the location of the first data byte of any frame or block. This offset is determined by summing the offset values for the previous blocks, and allows direct access to a frame without reading through any portion of the image frames. For JPEG applications, these offsets are to the Start Of Image (SOI) markers, which are always the first element for each JPEG compressed frame.

Table 12-1 defines the format for the NITF controlled tagged record extension bearing the tag of NBLOCA. This extension is meant to be stored in the NITF image subheader portion of the NITF file structure.

TABLE 12-1. NBLOCA FORMAT

R = Required, O = Optional, C = Conditional

FIELD	DESCRIPTION	LENGTH (BYTES)	VALUE RANGE	TYPE
CETAG	Unique Extension Identifier	6	NBLOCA	R
CEL	Length of CEDATA Fields (note 1)	5	00008 to 99988	R
FRAME_1_OFFSET	First Image Frame Offset. From beginning of NITF image subheader (note2).	4	note 2	R
NUMBER_ OF_FRAMES	Number of Blocks. Number of blocks for which offsets are listed.	4	note 3	R
FRAME_2_OFFSET	Second Image Frame Offset. Offset in Bytes of the beginning of the 2nd image frame from the beginning of the 1st image frame (note 5).	4	note 4	C
....	....	....	....	....
FRAME_N_OFFSET	Frame Offset. Offset in bytes of the beginning of the nth image frame from the beginning of the N-1 image frame.	4	note 4	C

Notes:
1. This value is dependent upon the number of image frame offsets, which are stored in this controlled data extension.
2. Value is stored in 4 byte unsigned binary integer representation with a range of 439 to 999999 (Bounds for image subheader size). This offset is equal to the size of the image subheader. The bytes are ordered from the most significant to the least significant.
3. Value is stored in 4 byte unsigned binary integer representation with a range of 1 to 24996 (Limits due to max size of CETAG). The bytes are ordered from the most significant to the least significant.
4. Value is stored in 4 byte unsigned binary integer representation with a range of 1 to (2**32 - 1). The bytes are ordered from the most significant to the least significant.
5. For JPEG applications, this is the offset between the SOI marker of the 2nd Image Frame from the SOI marker of the 1st Image Frame.

13.0 OFFSET TAGGED RECORD EXTENSION DESCRIPTION

This definition establishes the format and provides a detailed description of the data and data format for the CE OFFSET to the NITF 2.0. This extension defines the offset of the first pixel of an NITF 2.0 image from the first pixel of the full image described by the accompanying support data. If the NITF 2.0 image is blocked differently from the full image, or is not aligned to the full image block structure, this extension allows the NITF 2.0 image to be located relative to the full image, such that the support data can be used properly. Table 13-1 defines the format for the controlled tagged record extension to the NITF bearing tag OFFSET.

TABLE 13-1. OFFSET FORMAT DESCRIPTION
R = Required

FIELD	DESCRIPTION	SIZE	FORMAT VALUE	TYPE
CETAG	Tag Record Identifier	1 to 6	OFFSET	R
CEL	Tag Data Field Length	5	00016	R
LINE	Align-Scan Offset of First Pixel	8	00000000 to 99999999	R
SAMPLE	Cross-Scan Offset of First Pixel	8	00000000 to 99999999	R

14.0 RULER EXTENSION

For information regarding this Tag(s) (MISC) refer to following:

Call the JITC Certification Test Facility at Commercial (520) 538-5458 or DSN 879-5458

15.0 HISTOA EXTENSION

15.1. INTRODUCTION

The Government is proposing a new controlled tag for NITFS called the Softcopy History Tag. The purpose of the tag is to provide a history of the softcopy processing functions that have been applied to NITF imagery. Although the tag was originally designed for National System Imagery, it can also be used to record the softcopy processing history of airborne and commercial imagery, provided that the imagery is processed in a manner consistent with the Softcopy History Tag. Ideally, the tag would be created whenever a national, airborne, or commercial image is formatted in NITF and updated each time the image is processed and saved by a softcopy processing system. If the Softcopy History Tag is approved by the NTB, it will become a new SDE (Support Data Extension).

15.2. BACKGROUND AND MOTIVATION

In 1996, the transmission formats of Systems B and D imagery were changed and additional processing improvements were added. An important piece of information, called the DMID (Data Mapping ID) was also added to the ESD (Exploitation Support Data). The DMID indicates the transmission format of Systems B and D imagery. In an effort to educate the community about the changes, the Government initiated an outreach effort to both the commercial and government softcopy exploitation system vendors. A small team of government contractors provided technical guidance to the vendors to optimize the processing and display of Systems B and D imagery. The team provided improved softcopy processing flows to each vendor, based on their existing chains. Implementation of these recommendations resulted in dramatic improvements in display quality across several of the softcopy exploitation systems.

During this effort, the team discovered that some of the exploitation systems could not implement the recommended processing flows. Specifically, some systems could not implement the required mapping functions to correctly display System B and D imagery, while others were limited to 8 bpp internal processing. These required mappings decode the transmission format of the data and produce “Display-Ready” imagery for Systems B and D. Display-Ready imagery requires only ELT (Electronic Light Table) functions for correct display. Fortunately, many of the ELT systems receive their data via DataMaster or (PMT) Product Management Tool. When requested, both DataMaster and PMT agreed to offer Systems B and D imagery with the Display-Ready mappings applied, if desired by the recipient. The DataMaster and PMT packages now offer Display-Ready products in 8 bpp or 11 bpp formats, as well as the original 8 bpp baseline formats for Systems B and D imagery.

Although many of the exploitation systems were pleased with the new capability offered by DataMaster and PMT, some vendors (e.g. DIEPS, MATRIX) expressed concern as to how their packages would differentiate between the Display-Ready products and the baseline formats. In addition, imagery users expressed frustration with the fact that softcopy-processing functions were being applied repeatedly to imagery, without their knowledge. This repetition of processing steps on a single image resulted in a degraded and sometimes unusable image. The users desired a method of recording the types and frequency of Softcopy processing steps applied to each image.

Based on these vendor and user concerns, the team recommended the creation of a “legacy record” or “history tag” for inclusion into the image support data for Systems B and D. Given the structure of the NITFS, the team suggested that the History Tag be implemented as a controlled SDE within the NITFS. The BHIST Tag was originally developed for Systems B and D and approved by the NTB in 1997. The purpose of the BHIST tag was to indicate the Display-Ready status of the image, to include the DMID from the ESD, and to provide a mechanism for tracking softcopy processing functions (e.g. Dynamic Range Adjustment, Sharpening, and Tonal Transfer Curve) applied to the image. (Refer to Appendix A for a complete description of these functions.) At the request of the Government, the tag was later expanded to include Systems A and C and renamed the Softcopy History Tag. Recently, the request was made and granted to include airborne and commercial imagery in the list of possible sources.

15.3 SOFTCOPY HISTORY TAG STRUCTURE

The primary purpose of the tag is to provide a history of the softcopy processing functions that are applied to NITF imagery by softcopy exploitation systems. Examples of such systems include, but are not limited to, IDEX, MATRIX, and DIEPS. The tag is meant to describe the state of the imagery as it is processed and distributed within the intelligence and imagery user community. In order to be effective, the tag shall be created whenever an image is formatted as a NITF image. After NITF formation, the tag shall be updated each time the image is processed and saved by a commercial or government softcopy processing system.

One method of determining if the History Tag has been updated each time the image is processed and saved is to compare the PDATE field in the most recent processing event and the IDATIM field in the NITF image subheader. If the PDATE field and the IDATIM field are identical, then the History Tag has been properly updated. If the fields are not identical, then the History Tag has not been properly updated and the data may not be accurate or timely.

The structure of the tag is based on "processing events" with the first event describing the processing immediately following NITF image formation. Each processing event consists of a series of fields that indicate the type of processing that has been applied to the image at that moment in time. In order to determine what processing has been applied to the image over time, the entire set of processing events must be read. Relevant information includes tonal processing, compression, image resolution, rectification, and magnification. A comment field is also provided in each processing event to allow users to capture relevant information not accounted for in the pre-defined fields. The proposed structure would allow for up to 99 separate processing events to be recorded. The basic structure of the tag is shown in table 15-1.

The first 8 fields within the tag are required to be filled when the tag is created, but are not repeated for each processing event. Therefore, when a NITF image is generated, the Softcopy History Tag would be structured as shown in table 15-1 and the first 8 fields would be filled. The population of all the fields in the tag shall be left justified with blanks included where necessary. In this document, a blank space is denoted by BCS 0x20, based on a recommendation by the JITC. Leading zeros may also be necessary in some of the numeric fields. A description of the first 8 fields in the tag is given in table 15-2.

TABLE 15-1. HISTOA SUBHEADER FIELDS
R = Required, C = Conditional

FIELD	NAME	SIZE	RANGE	TYPE
CETAG	Unique Extension ID	6	HISTOA	R
CEL	Length of Extension Tag	5	000126 to 83512	R
SYSTYPE	System Type	20	alphanumeric	R
PC	Prior Compression	12	alphanumeric	R
PE	Prior Enhancements	4	alphanumeric	R
REMAP_FLAG	System Specific Remap	1	0 to 9; BCS 0x20	R
LUTID	Data Mapping ID from the ESD	2	00 to 64	R
NEVENTS	Number of Processing Events	2	01 to 99	R
EVENT01	First Processing Event	variable	alphanumeric	R
...	...	...	...	...
EVENTnn	Most Recent Processing Event	variable	alphanumeric	C

TABLE 15-2. HISTOA SUBHEADER FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
CETAG	This field shall contain the unique extension name or ID for the Softcopy History Tag. Since this is version A of the history tag, this field will be filled with HISTOA.
CEL	This field shall contain the total length of the tag data (all of which follows this field), including all existing process events.
SYSTYPE	This field shall contain the name of the sensor from which the original image was collected. For national imagery, the valid field codes are SystemA, SystemB, SystemC, and SystemD. These codes shall not be used to indicate any other airborne or commercial systems and are reserved solely for the National systems. The codes in the SYSTYPE field shall be left justified and the remainder of the field filled with blanks to 20 characters. The NTB has requested that this tag be able to handle other types of airborne and commercial imagery currently supported by NITF. Additional valid field codes are listed below: ASARS-2 ASARS System GHR Global Hawk Radar SYERS-EO SYERS Electro-Optical System SYERS-MSI SYERS Multispectral System SYERS-IR SYERS Infrared System DSR Dark Star Radar TSAR TESAR TBD Other
PC	This field shall contain an alphanumeric string that indicates if bandwidth compression/expansion was applied to the image prior to NITF image creation. This field should be used in conjunction with the PE field to determine the state of the image prior to NITF formation. The valid field codes for the PC field is 4 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate or the quality level. The types of compression are indicated by the following codes: Value Definition DP43 DPCM (Differential Pulse Coded Modulation) – 4.3 bpp DC13 DCT (Discrete Cosine Transform – 2.3 bpp DC23 DCT (Discrete Cosine Transform) – 2.3 bpp NJNL NITFIRD JPEG – Lossless JNQ0 NITFIRD JPEG – Quality Level 0 JNQ1 NITFIRD JPEG – Quality Level 1 JNQ2 NITFIRD JPEG – Quality Level 2 C11D NITF Bi-level – 1D C12S NITF Bi-level – 2DS C12H NITF Bi-level – 2DH M11D NITF Bi-level – 1D M12S NITF Bi-level with masked blocks – 2DS M12H NITF Bi-level with masked blocks – 2DH C207 NITF ARIDPCM – 0.75 bpp C214 NITF ARIDPCM – 1.40 bpp C223 NITF ARIDPCM – 2.30 bpp C245 NITF ARIDPCM – 4.50 bpp C3Q0 NITF Lossy JPEG – Q0 Custom Tables C3Q1 NITF Lossy JPEG – Q1 Default Tables C3Q2 NITF Lossy JPEG – Q2 Default Tables

TABLE 15-2. SUBHEADER FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PC (continued)	C3Q3 NITF Lossy JPEG – Q2 Default Tables C3Q4 NITF Lossy JPEG – Q4 Default Tables C3Q5 NITF Lossy JPEG – Q5 Default Tables M3Q0 NITF Lossy JPEG with masked blocks – Q0 Custom M3Q1 NITF Lossy JPEG with masked blocks – Q1 Default M3Q2 NITF Lossy JPEG with masked blocks – Q2 Default M3Q3 NITF Lossy JPEG with masked blocks – Q3 Default M3Q4 NITF Lossy JPEG with masked blocks – Q4 Default M3Q5 NITF Lossy JPEG with masked blocks – Q5 Default C4LO NITF Vector Quantization – Lossy M4LO NITF Vector Quantization with masked blocks C5NL NITF Lossless JPEG M4NL NITF Lossless JPEG with masked blocks NC00 NITF uncompressed NM00 NITF with masked blocks uncompressed I1Q1 NITF Downsample JPEG – Q1 I1Q2 NITF Downsample JPEG – Q2 I1Q3 NITF Downsample JPEG – Q3 I1Q4 NITF Downsample JPEG – Q4 I1Q5 NITF Downsample JPEG – Q5 WVLO Wavelet Lossy WVNL Wavelet Lossless JP20 JPEG 2000 NONE No Compression UNKC Unknown Compression The entire PC field is 12 bytes long to allow for the concatenation of up to 3 compression algorithms. Consecutive 4 byte character strings shall indicate the application of two or three compression algorithms in succession. If only one compression algorithm is applied then the last eight characters are zero. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown compression (UNKC) shall be used. Examples of valid codes for the PC field are shown below. The DP43DC130000 code indicates that a concatenation of the 4.3 DPCM and the 1.3 DCT compression and expansion was applied to the image prior to its NITF formation. The NONE00000000 code indicates that no compression was applied to the image prior to its NITF formation.

TABLE 15-2. SUBHEADER FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PE	This field shall contain an alphanumeric string that indicates if any enhancements were applied to the image prior to NITF image creation. This field should be used in conjunction with the PC field to determine the state of the image prior to NITF formation. The valid field codes for the PC field are given below EH08 Enhanced 8 bpp from IDEX EH11 Enhanced 11 bpp from IDEX UE08 8 bpp data with DRA but no enhancements from IDEX EU11 Unenhanced 22 bpp from IDEX DGHC Digitized Hardcopy UNKP Unknown Processing NONE No prior processing The first four codes explicitly define the types of ODS (Output Data Server) products that are available for NITF formation. Additional codes may be added for airborne systems. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown processing (UNKP) shall be used.
REMAP_FLAG	This field shall indicate whether or not a system specific remap has been applied to the image. The valid field codes are 0 – 9, and a blank (BCS 0x20), but 2 – 9 are reserved for future use. A value of 0 means that no systems specific remap has been applied. A value of 1 means that the System C specific 16 – 12 bit remap has been applied to the System C image. If the image is not a System C image, this field does not apply at this time and should be filled with a blank. Values from 2 – 9 are reserved for future use and shall not be used at this time.
LUTID	This field shall contain the DMID (Data Mapping ID) for Systems B and D imagery. The DMID is contained in IMDAT records 97 and 98 in the ESD (Exploitation Support Data). This information is also referenced in IF200EAA. The valid field codes are 07, 08, and 12 – 64. A value of 07 and 08 indicates that the image is PEDF (Piecewise Extended Density Format). A value between 12 and 64 indicates that the image is a Linlog formatted image. Numbers between 01 and 06, 09, 10, and 11 are reserved and should not be used at this time. There are no valid DMID values greater than 64. NITF users to help determine what type of processing should be applied to the image can use this field. For all other systems, this field should be filled with 00.
NEVENTS	This field shall contain the number of processing events associated with the image. The tag is designed to record up to 99 separate processing events. The valid field codes are 01 to 99. The processing events are listed in chronological order, starting with the first event and ending with the most recent processing event. The first processing event shall be the processing immediately following the generation of the NITF formatted image. Each successive processing event is to record what transformations have been applied to the image, once the image has been processed and saved.

15.3.1 DEFINITION OF THE PROCESSING EVENTS

In addition to populating the first 8 fields, the originator of the NITF image will create the first processing event and then populate the applicable fields. In terms of implementation, a processing event is similar to a record. The NEVENTS field is a repetition factor that determines how many records or processing events must be read. A processing event has been defined as one or more of the specific processing functions shown in table 15-3 that may be applied to the NITF formatted image. In order to determine what processing has been applied to the image over time, the entire set of processing events must be read. In order these functions include compression and expansion, rotation, sharpening, magnification, and are normally applied to the imagery by commercial or government softcopy packages, such as IDEX, DIEPS, or MATRIX. A description of the Processing Event Fields is given in table 15-4.

TABLE 15-3. PROCESSING EVENT FIELDS
R = Required, C = Conditional

FIELD	NAME	SIZE	RANGE	TYPE
PDATE	Processing Date and Time	14	CCYYMMDDHHmmSS	R
PSITE	Processing Site	10	alphanumeric	R
PAS	Softcopy Processing Application	10	alphanumeric	R
NIPCOM	Number of Image Processing Comments	1	0 to 9	R
IPCOM1	Image Processing Comment 1	80	alphanumeric	C
IPCOMn	Image Processing Comment n	80	alphanumeric	C
IBPP	Input Bit Depth (actual)	2	01 to 64	R
IPVTYPE	Input Pixel Value Type	3	alphanumeric	R
INBWG	Input Bandwidth Compression	10	alphanumeric	R
DISP_FLAG	Display-Ready Flag	1	0 to 9, BCS 0x20	R
ROT_FLAG	Image Rotation	1	0, 1	R
ROT_ANGLE	Angle of Rotation	8	000.0000 to 359.9999	C
PROJ_FLAG	Image Projection	1	0, 1	R
ASYM_FLAG	Asymmetric Correction	1	0, 1, BCS 0x20	R
ZOOMROW	Mag in Line (row) Direction	7	00.0000 to 99.9999	C
ZOOMCOL	Mag in Element (column) Direction	7	00.0000 to 99.9999	C
SHARP_FLAG	Sharpening	1	0,1	R
SHARPFAM	Sharpening Family Number	2	-1, 00 to 99	C
SHARPMEM	Sharpening Member Number	2	-1, 00 to 99	C
MAG_FLAG	Symmetrical Magnification	1	0, 1	R
MAG_LEVEL	Level of Relative Magnification	7	00.0000 to 99.9999	C
DRA_FLAG	Dynamic Range Adjustment (DRA)	1	0, 1, 2	R
DRA_MULT	DRA Multiplier	7	000.000 to 999.999	C
DRA_SUB	DRA Subtractor	5	-9999 to +9999	C
TTC_FLAG	Tonal Transfer Curve (TTC)	1	0,1	R
TTCFAM	TTC Family Number	2	-1, 00 to 99	C
TTCMEM	TTC Member Number	2	-1, 00 to 99	C
DEVLUT_FLAG	Device LUT	1	O, 1	R
OBPP	Output Bit Depth (actual)	2	01 to 64	R
OPVTYPE	Output Pixel Value Type	3	alphanumeric	R
OUTBWC	Output Bandwidth Compression	10	alphanumeric	R

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
PDATE	This field shall contain the date and time (UTC) on which the processing event occurred. The valid form of the field is CCYYMMDDhhmmss, where CC is the first two digits of the year (00 to 99), YY is the last two digits of the year (00 to 99), MM is the month (01 to 12), DD is the day of the month (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC (Zulu) is assumed to be the time zone designator to express the time of day. This field can be used in conjunction with the IDATIM field in the NITF image subheader to determine if the History Tag has been updated each time the image was processed and saved. If the PDATE field and the IDATIM field are identical, the History Tag has been properly updated. If the fields are not identical, then the History Tag has not been properly updated and the data may not be accurate or timely.
PSITE	This field shall contain the name of the site or segment that performed the processing event. This 10 character alphanumeric field is free form text. Examples of PSITE entries are FOS, JWAC, or CENTCOM.
PAS	This field shall contain the processing application software used to perform the processing steps cited in the event (e.g. IDEX, VITEC, or DIEPS). The version number of the application would also be helpful to include in this field.
NIPCOM	This field shall contain the valid number of free text image processing comments. The valid field codes are 0 to 9.
IPCOM1	This field shall contain the first line of comment text. The fields IPCOM1 to IPCOMn, if present shall contain free form alphanumeric text. They are intended for use as a single comment block and shall be used that way. This field shall be omitted if the value in NIPCOM field is zero. The comment field shall be used to clarify or indicate special processing not accounted for in the Processing Event Fields. Reasons for populating this field would be to indicate alternate processing for multi-spectral imagery, to indicate the order of S/C processing steps contained within a single processing event, or to inform downstream users of potential problems with the image.
IPCOMn	This field shall contain the n^{th} line of comment text, based on the value of the NIPCOM field. See description above for IPCOM1 for usage. This field shall be omitted if the value in NIPCOM field is zero.
IBPP	This field shall contain the number of significant bits for each pixel before the processing functions denoted in the processing event have been performed and before compression. This type of pixel depth description is consistent with the ABPP field within the NITF image subheader. For example, if an 11-bpp word is stored in 16 bits, this field would contain 11 and the NBPP field in the NITF image subheader would contain 16. The valid IBPP field codes are 01 to 64, indicating 1 to 64 bpp.
IPVTYPE	This field shall contain an indicator of the type of computer representation used for the value of each pixel before the processing functions denoted in the processing events have been performed and before compression. Valid entries are INT for integer, SI for 2's complement signed integer, R for real, and C for complex. The databits of INT and SI values shall appear in the file in order of significance, beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating-point representation (IEEE754). C values shall be represented with the Real and Imaginary parts each represented in IEEE 32-bit floating point representation (IEEE754) and appearing adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
INBWG	This field shall indicate the type of bandwidth compression or expansion that has been applied to the image prior to the tonal enhancements denoted in the processing event. The valid field codes to describe each type of compression are 5 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate or the quality level. The last character indicates if the process is compression or an expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by the following codes: Value — Definition DP43 — DPCM (Differential Pulse Coded Modulation) – 4.3 bpp DC13 — DCT (Discrete Cosine Transform – 2.3 bpp DC23 — DCT (Discrete Cosine Transform) – 2.3 bpp NJNL — NITFIRD JPEG – Lossless JNQ0 — NITFIRD JPEG – Quality Level 0 JNQ1 — NITFIRD JPEG – Quality Level 1 JNQ2 — NITFIRD JPEG – Quality Level 2 C11D — NITF Bi-level – 1D C12S — NITF Bi-level – 2DS C12H — NITF Bi-level – 2DH M11D — NITF Bi-level – 1D M12S — NITF Bi-level with masked blocks – 2DS M12H — NITF Bi-level with masked blocks – 2DH C207 — NITF ARIDPCM – 0.75 bpp C214 — NITF ARIDPCM – 1.40 bpp C223 — NITF ARIDPCM – 2.30 bpp C245 — NITF ARIDPCM – 4.50 bpp C3Q0 — NITF Lossy JPEG – Q0 Custom Tables C3Q1 — NITF Lossy JPEG – Q1 Default Tables C3Q2 — NITF Lossy JPEG – Q2 Default Tables C3Q3 — NITF Lossy JPEG – Q2 Default Tables C3Q4 — NITF Lossy JPEG – Q4 Default Tables C3Q5 — NITF Lossy JPEG – Q5 Default Tables M3Q0 — NITF Lossy JPEG with masked blocks – Q0 Custom M3Q1 — NITF Lossy JPEG with masked blocks – Q1 Default M3Q2 — NITF Lossy JPEG with masked blocks – Q2 Default M3Q3 — NITF Lossy JPEG with masked blocks – Q3 Default M3Q4 — NITF Lossy JPEG with masked blocks – Q4 Default M3Q5 — NITF Lossy JPEG with masked blocks – Q5 Default C4LO — NITF Vector Quantization – Lossy M4LO — NITF Vector Quantization with masked blocks C5NL — NITF Lossless JPEG M4NL — NITF Lossless JPEG with masked blocks NC00 — NITF uncompressed NM00 — NITF with masked blocks uncompressed I1Q1 — NITF Downsample JPEG – Q1 I1Q2 — NITF Downsample JPEG – Q2 I1Q3 — NITF Downsample JPEG – Q3 I1Q4 — NITF Downsample JPEG – Q4

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
INBWG (continued)	I1Q5 NITF Downsample JPEG – Q5 WVLO Wavelet Lossy WVNL Wavelet Lossless JP20 JPEG 2000 NONE No Compression UNKC Unknown Compression OTLO Unknown lossy compression – requires mandatory IPCOM entry to explain technique or source OTNL Unknown lossless compression – requires mandatory IPCOM entry to explain technique or source The entire BWC field is 10 bytes long to allow for the concatenation of up to 2 compression algorithms. Two consecutive 5 byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining 5 characters are zero. Examples of valid codes for the BWC field are shown below. The DP43E00000 code indicates that a 4.3 DPCM compressed input image was expanded prior to NITF formation. The DC13E00000 code indicates that 1.3 DCT compressed input image was expanded prior to NITF formation. The NONE000000 code indicates that the input image to the NITF formation process was uncompressed.
DISP_FLAG	This field shall indicate if the image is “Display-Ready.” The DISP_FLAG field applies only to System B, System D, and certain other systems. Display-Ready data has had a system-specific transformation applied to it that is described in appendix A. The valid field codes are 0 to 9 and a blank (BCS 0x20). A value of 0 means that image is not Display-Ready and must be converted to a displayable format, using the pre-defined mappings for Linlog or PEDF formats. A value of 1 means that the image is Display-Ready and needs only basic tonal processing and device compensation for corrects display. Since this field applies to Systems B and D imagery currently, the field shall be filled with a blank (BCS 0x20) for all other system types. Values 2 to 9 are reserved for future use and shall not be used at this time. A more detailed explanation of the Display-Ready transformations is provided in appendix A.
ROT_FLAG	This field shall indicate if the image has been rotated. The valid field codes are 0 and 1. A value or 0 means that the image has not been rotated. A value of 1 means that the image has been rotated. If this field is equal to 1, then the ROT_ANGLE field must be filled with the angle of rotation.
ROT_ANGLE	This field shall contain the angel in degrees that the image has been rotated, where a positive angle denotes clockwise rotation. The valid field codes are 000.0000 to 359.9999. This field is conditional on the ROT_FLAG field being equal to 1. If the rotation has included an interpolation, then the interpolation method shall be described in the comment sections.

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
ASYM_FLAG	This field shall indicate if asymmetric correction has been applied to the image. This processing step is only allowed for certain types of EO processing. The valid field codes are 0 and 1, and a blank (BCS 0x20). A value of 0 means that asymmetric correction has not been applied to the image. A value of 1 means that asymmetric correction has been applied to the image. Since this field applies only to certain types of EO imagery, this field shall be filled with a blank (BCS 0x20) for all other system types. If this field is equal to 1, the ZOOMROW and ZOOMCOL fields must be filled with the magnification levels in the row (line) and column (element) directions, respectively.
ZOOMROW	This field shall contain the level of magnification that was applied to the image in the line or row direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.
ZOOMCOL	This field shall contain the level of magnification that was applied to the image in the element or column direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.
PROJ_FLAG	This field shall indicate if the image has been projected from the collection geometry into geometry more suitable for display. The valid field codes are 0 and 1. A value of 0 means that no geometric transformation has been applied to the image, meaning it is probably stilled in the collection geometry. A value of 1 means that the image has been projected into another geometry. If this field is equal to 1, then a description of the projection or rectification shall be given in the comment section.
SHARP_FLAG	This field shall indicate if the image has been passed through a sharpening operation. The valid field codes are 0 and 1. A value of 0 means that no sharpening has been applied to the image. A value of 1 means that sharpening has been applied to the image. If this field is equal to 1, then the SHARPFAM and SHARPMEN fields must be filled with the appropriate numbers. Refer to paragraph 15.5 for a more complete description of the sharpening kernel database.
SHARPFAM	This field shall contain the number of the sharpening family, if a sharpening operation was applied to the image. The valid field codes are –1, 00 to 99. This field is conditional on the SHARP_FLAG field. Although the IDEX sharpening family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the sharpening kernel is not a part of the existing group of families and members, a value of – shall be placed in this field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph 15-5 for a more complete description of the sharpening kernel database.
SHARPMEM	This field shall contain the number of the sharpening member, if a sharpening operation was applied to the image. The valid field codes are –1, 00 to 99. This field is conditional on the SHARP_FLAG field. If the sharpening kernel is not a part of the existing group of families and members, a value of –1 shall be placed in this field and the nature of the sharpening kernel shall be specified in the comment section. Refer to 15.5 for a more complete description of the sharpening database.

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
MAG_FLAG	This field shall indicate if the image has been symmetrically (same amount in each direction) magnified during this processing step. The valid field codes are 0 and 1. A value of 0 means that the image was not magnified. A value of 1 means that the image has been magnified. If this field is equal to 1, then the MAG_LEVEL field shall be filled with the level of magnification.
MAG_LEVEL	This field shall contain the level of symmetrical magnification that has been applied to the image relative to the input image at this processing step. For example, a value of 02.0000 would indicate a 2X magnification relative to the input image. The valid field codes are 00.0000 to 99.9999. This field is conditional on the MAG_FLAG field. A value greater than 1 shall indicate that the image was magnified to a size larger than its previous size and a value less than 1 shall indicate the image size was decreased. The method of magnification shall be described in the comment section.
DRA_FLAG	This field shall indicate if a dynamic Range Adjustment (DRA) has been applied to the image. DRA is an affine transformation of the image pixel values of the form Y = DRA_MULT*(X – DRA_SUB), where X is the input pixel value, DRA_SUB is the DRA subtractor, DRA_MULT is the DRA multiplier, and Y is the output pixel value. The DRA is said to be spatially invariant when the DRA subtractor and DRA multiplier do not depend on pixel position. If the DRA subtractor and DRA multiplier do depend on pixel position, the DRA is said to be spatially variant. The valid field codes are 0, 1, and 2. A value of 0 means that a DRA has not been applied to the image. A value of 1 means that a spatially invariant DRA has been applied to the image. In this case, the DRA_SUB and DRA_MULT fields shall be filled with the appropriate codes. A value of 2 means that a spatially variant DRA has been applied to the image. In cases where DRA_FLAG equals 0 or 2, the DRA_SUB and DRA_MULT fields shall not be filled.
DRA_MULT	This field shall contain the multiplier value of the DRA. The valid field codes are 000.000 to 999.999. This field is conditional on the DRA_FLAG field being equal to 1.
DRA_SUB	This field shall contain the subtractor value of the DRA. The valid field codes are 000.000 to 999.999. This field is conditional on the DRA_FLAG field being equal to 1.
TTC_FLAG	This field shall indicate if a TTC (Tonal Transfer Curve) has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a TTC has not been applied to the image. A value of 1 means that a TTC has been applied to the image. If a TTC has been applied, then the TTCFAM and TTCNUM fields shall be filled with the appropriate codes. Refer to paragraph 15-5 for more complete description of the TTC database.
TTCFAM	This field shall contain the number of the TTC family, if a TTC was applied to the image. The valid field codes are –1, 00 to 99. This field is conditional on the TTC_FLAG field. Although the IDEXZ TTC family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the TTC is not a part of the existing group of families and members, a value of –1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph 15-5 for a more complete description of the TTC database.

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
TTCMEM	This field shall contain the number of the TTC member, if a TTC was applied to the image. The valid field codes are 00 to 99. This field is conditional on the TTC_FLAG field. If the TTC is not a part of the existing group of families and members, a value of –1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph 15-5 for a more complete description of the TTC database.
DEVLUT_FLAG	This field shall indicate if device compensation LUT has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a device LUT has not been applied to the image. A value of 1 means that t device LUT has been applied to the image. The nature of the LUT may be specified in the comment section and should include the device for which the LUT is applied. If the device is not known, an appropriate method for describing the LUT shall be given.
OBPP	This field shall contain the number of significant bits for each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. For example, if an 8 bpp System B image is mapped into Display-Ready space using the proper 8 to 11 bpp transformation (see appendix A), the IBPP field shall contain the actual number of data pixels, not the word length. For example, if an 11-bpp word were stored in 16 bits, this field would contain 11. The valid OBPP field codes are 01 to 64, indicating 1 to 64 bpp. In many cases, this field will match the IBPP field.
OPVTYPE	This field shall contain an indicator of the type of computer representation used for the value of each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. Valid entries are INT for integer, B for bi-level, SI for 2's complement signed integer, R for real, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating-point representation (IEEE754). C values shall be represented with the Real and Imaginary parts each 32-bit floating point representation (IEEE754) and appearing adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.

TABLE 15-4. PROCESSING EVENT FIELD DESCRIPTIONS (CONTINUED)

FIELD	VALUE DEFINITIONS AND CONSTRAINTS
OUTBWC	This field shall indicate the type of bandwidth compression that has been applied to the image after the tonal enhancements denoted in the processing event have been applied. The valid field codes to describe each type of compression are 5 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate or the quality level. The last character indicates if the process is compression or an expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by the same codes used in the INBWC field and can be found in the field description for INBWC. The entire BWC field is 10 bytes long to allow for the concatenation of up to 2 compression algorithms. Two consecutive 5 byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining 5 characters are zero. Examples of valid codes for the BWC field are shown below. The NJQ1C00000 code indicates that the processed image was saved as a NITFIRD JPEG lossless compressed image. The NJNLC00000 indicates that the processed image was saved as a NITFIRD JPEG lossless compressed image. The C3Q3C00000 code indicates that the processed image was saved as a NITFS JPEG compressed image at quality level 3.

15.3.2 USE OF THE COMMENTS FIELD

The comment field within the Softcopy History Tag is consistent with the current NITFS image subheader. The NIPCOM field indicates how many lines of comments are utilized in each processing event. Each line of comments is 80 bytes and the maximum number of lines is 9. These lines of comments within the tag are provided in each processing event to allow users to capture relevant information not accounted for in the pre-defined fields. The types of information that might be included are an unknown input data format, a compression algorithm not accounted for in the BWC field, or details on the interpolation algorithm used for image rotation. If warping or magnification is performed on the image, the details of these functions could be described in the comment section. The Softcopy History Tag assumes that the ELT package is using the IDEX-based sharpening kernels and TTCs. If an ELT package is using another type of sharpening kernel or tonal adjustment, the comment field could be used to describe these functions.

Another use for the comments field would be to describe processing functions on imagery that have not yet been standardized or well-defined. One such example is multi-spectral image products. Softcopy processing of MSI products is still in the experimental stages and a standard processing flow has not been defined. If the Softcopy History Tag is used with an MSI product, the comment section could be used to describe new processing techniques developed for this imagery.

15.4 ADDITIONAL INFORMATION

The following information is from the Softcopy Image Processing Chain Baseline document developed by the Image Chain Analysis group at Eastman Kodak, dated January 27, 1998.

15.4.1 DISPLAY-READY TRANSFORMATIONS

The Display-Ready transformations to be applied to Systems B and D imagery depend on the format, as indicated by the DMID (Data Mapping Identifier) in the ESD (Exploitation Support Data). A DMID value of 7 or 8 indicates that the image is in PEDF (Piecewise Extended Density Format), the default format of System B imagery. A DMID value between 12 and 64 indicates that the image is in Linlog format. Linlog is the System D default format and Linlog format is available by special request from System B.

15.4.2 SYSTEM B PEDF DATA

PEDF is the default format for System B. The 8 bpp PEDF data must be transformed into a displayable density format commonly called Display-Ready, prior to enhancement and display. The equations below are used to expand the 8 bpp PEDF data to displayable 11 bpp or 8 bpp density format data. The recommended transformation from 8 bpp PEDF is the 11-bpp-density format mapping (11bDF), shown in equation A.1. Softcopy exploitation systems limited to an 8-bpp-bit depth should use the 8-bpp conversion, shown in equation A.2, to convert 8 bpp PEDF to 8-bpp density format (8bDF).

These equations are used to expand the 8 bpp PEDF data to displayable 11 bpp or 8 bpp density format data.

11 bpp Density Format (11bDF)

$$11\,\mathrm{bDF}(i) = \frac{2047}{382.5} \cdot \begin{cases} i & i \le 127.5 \\ 2 \cdot (i - 127.5) + 127.5 & i > 127.5 \end{cases} \qquad \text{(A.1)}$$

The input range is $0 \le i \le 255$. The output is an 11-bpp integer.

8 bpp Density Format (8bDF)

$$8\,\mathrm{bDF}(i) = \min\left(\max\left(i, 2 \cdot (i - 127.5)\right) + 127.5, 255\right) \qquad \text{(A.2)}$$

The input range is $0 \le i \le 255$. The output is an 8-bpp integer.

15.4.3 SYSTEM B AND D LINLOG DATA

Linlog format is the 8-bpp-default format for System D and is available on request from System B. The 8 bpp Linlog format must be transformed into a displayable format, referred to as Display-Ready. The equations below are used to expand the 8 bpp Linlog data to displayable 11 bpp or 8-bpp log format data. The recommended transformation from 8 bpp Linlog is the 11-bpp-log format mapping (11bLF), shown in equation A.3. Softcopy exploitation systems limited to an 8 bpp bit depth should use the 8 bpp conversion, shown in equation A.4, to convert 8 bpp Linlog to 8 bpp log format (8bLF).

These equations are used to expand the 8-bpp Linlog data to displayable 11 bpp or 8-bpp-log format.

11 bpp Log Format (11bLF)

$$11bLF(i) = \frac{2047}{15}\begin{cases} 0 & i = 0 \\ \log_2(i) & 0 < i \le 117 \\ \log_2\left[2^{\frac{i}{(17)}} - 1\right] & i > 117 \end{cases} \quad \text{(A.3)}$$

The input range is $0 \le i \le 255$. The output is an 11-bpp integer.

8 bpp Log Format (8bLF)

$$8bLF(i) = \frac{255}{15}\begin{cases} 0 & i = 0 \\ \log_2(i) & 0 < i \le 117 \\ \log_2\left[2^{\frac{i}{(17)}} - 1\right] & i > 117 \end{cases} \quad \text{(A.4)}$$

The input range is $0 \le i \le 255$. The output is an 8-bpp integer.

15.5 SHARPENING FAMILIES

The Sharpening Family 0 provides control of the modulation in the high frequency region of the scene spectrum. The strength of the sharpening kernels varies from moderate blurring, using a gain of 0.6 to very strong edge enhancement, and using a gain of 32. Family 0 provides adequate sharpness for all modes of imagery and is the default family for all image sources. Figure 15-1 depicts Sharpening Family 0: members 0 to 63. Each member increases in gain in equal log steps. This is done in order to achieve equal changes in perception of sharpness. These kernels are actually 3x3 kernels in a 5x5 filter design; i.e. the outside values of the kernel are zero and may be omitted for fast processing.

The Sharpening Family 1 provides the same type of control as Family 0, but with a much finer control. The strength of the compensation ranges from a blurring kernel with a gain of 0.8 to a maximum edge enhancement using a gain of 25. Figure 15-2 depicts Sharpening Family 1: members 0 through 63. Each member increases in gain at the Nyquist frequency in equal log steps.

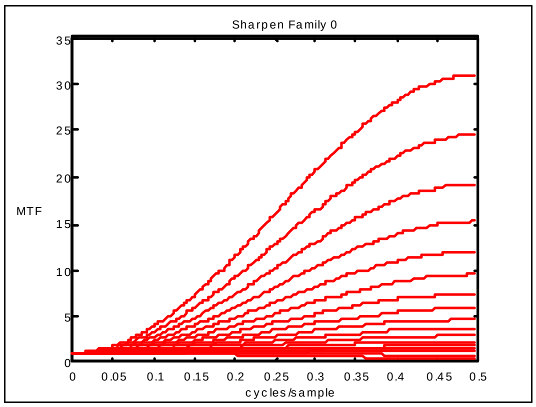

FIGURE 15-1. SHARPENING FAMILY 0: MEMBERS 0 TO 63

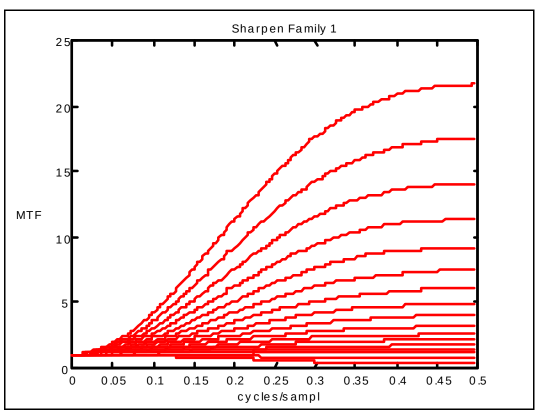

FIGURE 15-2. SHARPENING FAMILY 1: MEMBERS 0 TO 63

15.6 TTC FAMILIES

The default TTC family can be used for all image sources and modes. The TTCs are designed to allow the user to manipulate the contrast of a displayed image by redistributing the image's histogram. The contrast can be changed to allow the visualization of scene characteristics. This includes shadow regions, highlights, and mid-tone regions in the image. The default TTC family is shown in Figure B-3. This TTC family has 64 members that vary from member 0, improving the shadow regions to member 32, providing no additional contrast to member 63, improving the highlight regions. All members in between these ranges offer slightly improved contrast and can be used for all image sources. All of the TTC families are available from the Government upon request.

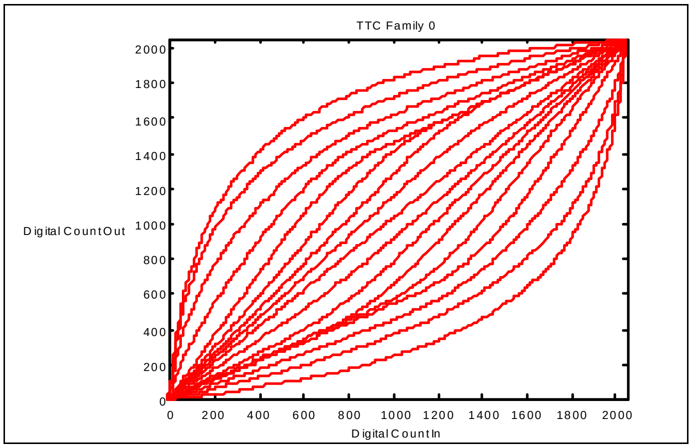

FIGURE 15-3. DEFAULT TCC FAMILY

16.0 SUPPORT DATA EXTENSION

For information regarding this National SDE contact Danny Rajan at the National Imagery and Mapping Agency (NIMA), voice, (703) 262-4416, or electronic mail, rajans@nima.mil.